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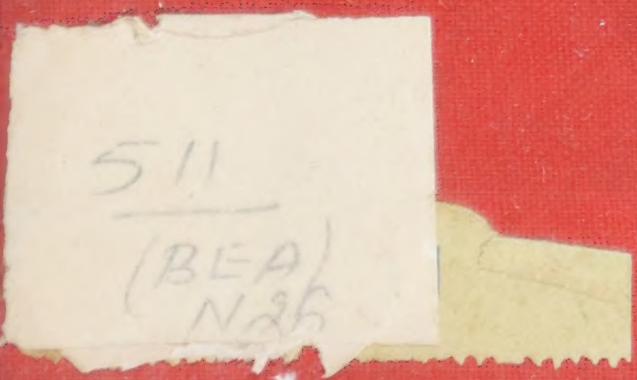

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PREFACE

THE contents of this book consist of thirty papers on the rules usually comprised in a junior course of Arithmetic, followed by sixty carefully graduated examination papers arranged as under :—

Papers 31–54 include the Simple and Compound Rules, Vulgar Fractions, Practice, Simple Proportion, the calculation of Simple Interest on a given principal, and the principles of Decimals (non-recurring) applied to the first four rules.

This section meets the requirements of the Oxford and Cambridge and the College of Preceptors' Preliminary Examinations.

Papers 55–72 include full Treatment of Decimals (non-recurring), the Metric System, Measurement of Areas and Volumes, Percentages and their application to Profit and Loss.

This section meets the requirements of the Oxford and Cambridge and the College of Preceptors' Junior Examinations.

Papers 73–90 include Recurring Decimals, questions

requiring rate and time in Simple Interest, Compound Interest, Stocks, Discount, and Square Root.

This section meets the requirements of the Oxford and Cambridge and the College of Preceptors' Senior Examinations, the examinations held by the Board of Education in Secondary Schools, the requirements of candidates competing for scholarships offered by the Technical Education Committees of County Councils, and the examinations for minor appointments in the Civil Service.

Each paper is so arranged that, by a scheme of marking with a maximum of 100, it is possible to compare readily the progress of pupils. The questions are graded in order of difficulty, and it is suggested that the maximum for questions 1–5 should be 8 marks each, for questions 6–8, 10 marks each, and for questions 9 and 10, 15 marks each.

W. S. B.

In the Ninth Edition a section on the Mensuration of Plane and Solid Figures has been inserted, and the Answers are being issued separately.

July 1920

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JUNIOR ARITHMETIC EXAMINATION PAPERS

1. 1. Find the difference between a million times ten and the tenth part of a million, and express the result in words.

2. Multiply five thousand six hundred and nine by seven thousand three hundred and eight, and express the result in words.

3. A mile is 1760 yards. How many miles are there in one million two hundred and seven thousand three hundred and sixty yards?

4. Find the product of the sum and the difference of 2041 and 3139, and write the answer in words.

5. Find the difference between the product of 1101 and 907, and the quotient of 538061 divided by 19.

6. If 221 words make a full page of print, how many pages of print will be required for a manuscript of 56722 words, and how many words will there be on the last page?

7. What is the smallest number which, being deducted from 378950, will make the latter exactly divisible by 1409?

8. What is the smallest number which added to 2389 multiplied by 8317 will give a result exactly divisible by their sum?

9. Four men were candidates at an election for town councillors. In all 9549 votes were cast for the candidates, B, C, and D obtaining 293, 316, and 358 respectively less than A, the candidate at the top of the poll. How many votes did each receive?

10. Two numbers added together make 112113 and their difference is 61757. Find the two numbers.

2. 1. How many guineas are there in 3566304 halfpence?

2. Add together £28. 3s. 4½d., £11. 2s. 10d., £7. 10s. 6¾d., and £16. 7s. 10¼d.; and subtract the sum from £100.

3. Multiply £742. 14s. 7¾d. by 8; and divide £34381. 9s. 11¼d. by 11.

4. Multiply £2837. 17s. 4¾d. by 17, using one line of multiplication; and divide £1850606. 2s. 2¼d. by 45, using repeated short division.

5. Multiply £3079. 11s. 5¼d by 875.

6. The cost of 79 dozen articles of equal value is £183. 13s. 6d. What is the cost of each article?

7. Divide £32561. 13s. 4d. into 721 equal shares, to the nearest penny of each share; and say what sum of money remains undivided.

8. What sum of money added to £4743. 2s. 11d. will be equal to thirteen times £364. 18s. 9¼d.?

9. How many pounds of tea at 2s. 4d. per pound can be bought for £1149. 1s.?

10. What two amounts have for their sum £4119. 14s. 2d. and for their difference £853. 16s. 2d.?

8. 1. Multiply £275. 18s. 6¼d. by 2705; and divide £1447. 18s. 4d. by 1000.

2. A collecting-box is found to contain 22 farthings, 75 halfpence, 132 pennies, 97 threepenny-bits, 69 sixpences, 29 shillings, 11 florins, and 3 half-crowns. What is the total amount in £ s. d.?

3. A fishmonger bought a salmon for £1. 2s. 4½d., and by selling it at 1s. 3d. per lb. he gained 10s. 9d. How many pounds did the salmon weigh?

4. The sum of £29. 6s. 10¼d. is contained in five bags. The first bag contains sovereigns only, the second half-sovereigns only, the third half-crowns only, the fourth florins only, and the fifth farthings only. If each bag contains the same number of coins, how many coins are there in each bag?

5. Divide £3. 15s. among three persons, so that for each shilling the first receives the second may get eighteen pence, and the third half-a-crown. State the value of each person's share.

6. A factory employs 47 men working 9 hours a day, 29 women working 8 hours a day, and 44 boys working 4 hours a day. If a man receives 10d., a woman 6d., and a boy 3d. for each hour's work, how much will be paid for wages in a week (6 days)?

7. The receipts for passenger traffic between two stations are £4497. 15s. One-half of this amount is derived from 1st class fares at 11s. 3d., and half from 3rd class fares at 4s. 6d. each. Find the number of passengers of each class.

8. In the distribution of a charity each child had 1s. 3½d., each woman twice as much, and each man three times as much. The whole sum distributed was £62, and men, women, and children were taken in equal numbers. How many persons were there in all?

9. A dealer buys 120 sheep at £3. 15s. each, and 12 cows at £17. 10s. If he sells the sheep for £500, what price must he obtain for each cow, on an average, so as to gain £100 on his total outlay?

10. A farmer takes a certain sum of money to market and buys 7 oxen and 20 sheep. He exchanges 2 oxen and 5 sheep for a horse valued at £45. He could have exchanged 15 sheep for the same horse. Find how much money he took to market.

4. **1.** If from 7 tons 8 cwt. 2 qrs. 14 lb. the weights 6 cwt. 1 qr. 27 lb., 19 cwt. 2 qrs. 17 lb., 17 cwt. 3 qrs. 25 lb., and 15 cwt. 2 qrs. 19 lb. are taken, what weight will remain?

2. Multiply 3 tons 4 cwt. 6 lb. by 29; and divide 3 cwt. 2 qrs. 22 lb. by 92.

3. Find the number of hours from noon on May 1st, 1903 to noon on March 1st, 1904.

4. How many minutes are there between a quarter past nine on Monday morning and half-past four on Friday afternoon of the same week?

5. A clock was put right at noon on June 1st, and it has ticked 3012000 times. Assuming it ticks every second, what day is it, and what time?

6. Find the weight in tons and cwt. of a mail of letters, consisting of 126 bags, each containing 2560 letters, and the average weight of each letter half-an-ounce.

7. How long would it take to count a million pennies, counting 125 each minute, and 9 hours a day?

8. If 220 lb. 7 oz. 12 dwt. 19 grs. of silver plate be divided equally among 13 persons, what will be the share of each?

9. Given that 5760 grains make a pound troy and 7000 grains make a pound avoirdupois, find how many pounds and ounces troy will equal 3 qrs. 12 lb. avoirdupois.

10. On a goods train 15 trucks can each carry 7 tons 2 cwt. 1 qr., and a certain number 8 tons 12 cwt. 3 qrs. The weight to be carried is 320 tons. If the smaller trucks were full, how many larger trucks will be required, and what will be the weight in the last truck?

5. 1. In 75863 pints how many quarters, bushels, pecks, etc.

2. Express 13 cubic yards 105 cubic feet in cubic inches.

3. How many acres, etc., are there in a million square yards?

4. If a man takes 8910 steps, each 32 inches in length, how many miles has he walked?

5. If the length of a man's step is 2 feet 9 inches, how many steps does he take in walking 3 miles 5 furlongs?

6. How many square yards are there in a plot of ground 162 feet long by 113 feet wide?

If a railway line is 220 miles long and 30 feet wide, find the acreage of the line.

7. How many allotments, each containing 2 ac. 1 ro. 8 po. can be made out of 50 acres of land; and how much more land is required to form another equal allotment?

8. How many layers of bricks will be required to raise a wall 52 feet high if each brick is 3 inches thick and rests on a layer of mortar $\frac{1}{4}$ inch thick?

9. A train travels 60 miles an hour and passes 8 telegraph posts in each 33 seconds. What is the distance between the posts?

10. A man taking two steps a second walks at the rate of 4 miles an hour. Show that each step is more than 35 inches and less than 36 inches.

8. 1. Define a *measure* of a number. Write down all the measures of 363 and of 231, and say what measures are common to both numbers.

2. Find the prime factors of 109956.

3. Find the G.C.M. of 1267083 and 1470442.

4. What is the least number which contains as factors 34, 35, 50, 51?

5. Resolve into prime factors 1974, 2961 and 4277; hence find the G.C.M. and L.C.M.

6. What is the least number which leaves 4 as remainder when divided either by 9, 99, 999, or 9999?

7. Two fields, measuring respectively 29 ac. 3 ro. and 36 ac. 3 ro., are divided into equal-sized garden plots. What is the largest possible size of one plot?

8. Find the smallest sum of money that can be exactly distributed either in half-crowns or half-guineas.

9. A number of penny pieces may be placed in piles of either 6, 9 or 12 each, and none be left over. If piles of 10 each be made, there will be 8 over. What is the smallest number of pennies with which this is possible?

10. On a rock are three revolving lights; one revolves in 2 minutes 12 seconds, another in 3 minutes 7 seconds, the third in 3 minutes 24 seconds. A coastguard saw them all bright at midnight; when will they next be so?

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7. 1. Reduce $\frac{12}{19}\frac{43}{74}\frac{21}{81}$ to its lowest terms.

2. Express 9 as a fraction with denominator 19; and find by what number must the denominator and numerator of $\frac{7}{9}$ be multiplied to raise it to $\frac{126}{182}$?

3. What fraction with 299 as denominator is equal to $\frac{17}{23}$, and what fraction with 87 as numerator is equal to $\frac{3}{4}$?

4. Add together $5\frac{5}{7}$, $4\frac{7}{8}$, $2\frac{5}{16}$, and $32\frac{5}{8}$; also $7\frac{5}{9}$, $11\frac{22}{35}$, $2\frac{16}{63}$, and $14\frac{14}{45}$.

5. Subtract $7\frac{7}{9}$ from $12\frac{3}{14}$; and from $62\frac{18}{81}$ take $45\frac{17}{54}$.

6. Find the value of $\frac{1}{8}-\frac{1}{9}+\frac{1}{10}-\frac{1}{11}+\frac{1}{12}$; and simplify $5\frac{2}{3}-3\frac{7}{8}+4\frac{5}{27}-\frac{35}{72}$.

7. Multiply $10\frac{0}{13}$ by $3\frac{2}{3}$; and find the continued product of $\frac{17}{24}$, $4\frac{5}{11}$, $2\frac{72}{17}$, and $4\frac{5}{7}$.

8. Divide $31\frac{0}{19}$ by 67; and $10\frac{1}{8}$ by $1\frac{1}{11}$.

9. Divide $2\frac{2}{15}$ of $2\frac{5}{8}$ by $\frac{7}{27}$; and simplify $\frac{1}{7}\times 7\frac{5}{8}\div\frac{3}{5}$ of $1\frac{7}{30}$.

10. Divide the difference between $\frac{7}{8}$ and $\frac{8}{10}$ by the sum of $1\frac{7}{10}$ and $1\frac{3}{4}$; and multiply the quotient by $3\frac{1}{7}$.

8. 1. From 1 take $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{8}$; and divide the remainder by $1\frac{1}{2}$ of $4\frac{8}{15}$.

2. Simplify $\frac{3}{22}$ of $6\frac{3}{5} - \frac{1}{18}$ of $4 - 2\frac{6}{7}$ of $1\frac{1}{6}$.

3. Simplify $3\frac{7}{18}$ of $\frac{4}{4}\frac{2}{2}\frac{6}{7} \div 71 + \frac{3}{65}$ of $\frac{5}{44}$ of $2\frac{3}{70} - \frac{7}{130}$ of $1\frac{11}{14}$.

4. Simplify $(1 + \frac{1}{15} - \frac{1}{3} + \frac{12}{35}) \div (1 + \frac{1}{3} - \frac{1}{2} + 1\frac{1}{20})$.

5. Simplify $2\frac{4}{5} + \frac{1}{4}$ of $(2\frac{1}{8} - \frac{5}{6})$; and $(2\frac{4}{5} + \frac{1}{4}) \div 2\frac{1}{8} - \frac{5}{6}$.

6. Simplify $\dfrac{\frac{1}{3} \text{ of } 2\frac{1}{7} + \frac{4}{5} \text{ of } 3\frac{1}{4}}{\frac{6}{7} \times 3\frac{1}{2} - 2\frac{1}{5} \div 1\frac{4}{7}}$.

7. Simplify $\dfrac{1\frac{1}{15} \text{ of } 2\frac{5}{8}}{5\frac{1}{3} - 4\frac{1}{2}} \div \dfrac{2\frac{1}{2} + 71\frac{2}{3}}{81\frac{2}{3} - 62\frac{1}{2}}$.

8. Simplify $\dfrac{3 - \frac{4}{11}}{4 + \dfrac{2}{1 - \frac{2}{13}}}$.

9. Simplify $\left\{ \dfrac{2\frac{1}{4} - \frac{2}{3} \times 1\frac{4}{6}}{3\frac{1}{3} \times \frac{1}{5} + \frac{13}{36}} - \dfrac{1}{2\frac{1}{2}} \right\} \div \dfrac{1}{1\frac{2}{3}}$.

10. Simplify $4 + \dfrac{1}{2 - \dfrac{3}{4 - \frac{1}{6}}} - \dfrac{10\frac{5}{9}}{2 + \dfrac{3}{4\frac{5}{6}}}$.

1. What sum must be added to $\frac{9}{10}$ of $\frac{11}{16}$ of $\frac{5}{27}$ of £2 to make up 10s.?

2. Find the value of $\frac{3}{8}$ of 9s. 2d. $+2\frac{1}{4}$ of 5s. 6d. $+\frac{2}{3}$ of $\frac{1}{2}$ of 6s. 8d.

3. What is the difference between $\frac{2}{3}$ of £1 $-\frac{5}{8}$ of 2s. 6d. $+$ $\frac{1}{4}$ of a crown and $\frac{3}{5}$ of a guinea $-\frac{2}{9}$ of 27s. $+\frac{4}{15}$ of a shilling?

4. What sum of money divided by $3\frac{3}{5}$ will give $7\frac{1}{8}$ shillings as quotient?

5. Divide £26. 7s. $7\frac{1}{4}$d. by $8\frac{1}{3}$; and multiply £37. 7s. 6d. by $5\frac{2}{3}$.

6. Find the value of $\frac{57}{112}$ of 8 tons; and the value of $2\frac{18}{19}$ of 3 tons 17 cwt. 3 qrs. 14 lb.

7. Add together $2\frac{1}{2}$ of 1 ton 6 cwt., $3\frac{1}{8}$ of 2 qrs. 16 lb., and $3\frac{3}{4}$ of 1 qr.

8. What fraction of $\frac{12}{5}$ of a crown is $\frac{5}{12}$ of a guinea?

9. Reduce £1640. 12s. 6d. to the fraction of one million pounds sterling; and express 1 lb. 11 oz. 16 dwt. as the fraction of 2 lb. 2 oz. 15 dwt. 12 grs.

10. What fraction of $\frac{5}{17}$ of 11 qrs. 5 bush. 2 pk. is equal to $\frac{3}{5}$ of 9 qrs. 1 bush. $1\frac{1}{3}$ pk.?

10. **1.** Write in decimal notation 5 hundredths, 5 hundreds 5 millionths ; add them, and multiply their sum by ·001.

2. Add together 1135·52, 365·579, 1·00456 and ·368145 ; and subtract 99·119118 from 100 and 17·2398 from 27·06.

3. Multiply 191·191 by 3651 ; ·3721 by ·40107 ; and ·000076 by ·0084.

4. Divide 69·173 by 31·3 ; 691·73 by ·0013 ; 3217 by ·00625 ; and ·9651 by 187·5.

5. Divide ·2926 by 190 ; 6·3114 by ·0314 ; and 173·6196 by ·007516.

6. Reduce $\frac{1}{16}$ and $2\frac{1}{256}$ to decimals, and divide their difference by ·00015625.

7. Express as a decimal $\frac{1}{8} + 2\frac{1}{25} + 1\frac{1}{125} + 8\frac{1}{625}$.

8. Simplify $\frac{\cdot 035 \times \cdot 0056}{\cdot 0007}$.

9. Simplify $\frac{2\cdot 004}{\cdot 167} \times \frac{3\cdot 375}{4}$.

10. Simplify $\frac{\cdot 161}{1\cdot 15} + \frac{\cdot 00576}{\cdot 12} + \frac{\cdot 250625}{2\cdot 5}$.

1. 1. Find the value of 1·025 of £1. 13s. 4d.

2. Express 3·0875 of a mile in inches.

3. Find the value of ·0016 of 7 days 5 hours 36 minutes 40 seconds.

4. Simplify 2·24 lb. + 7·12 cwt. + 4·643 tons.

5. From a rope 3·159 yards long, how many pieces ·038 of a yard long can be cut, and how long is the remainder? Express the length of the remainder as a decimal of an inch.

6. Add together ·725 of £1, 7·25 of half-a-crown, and 6·875 of a shilling.

7. Find the value of ·00125 ton + ·0125 cwt. + ·025 lb., and reduce the result to the decimal of 2 qrs. 9 lb.

8. Express 15s. 7½d. as the decimal of £5; and 5¼ guineas as the decimal of £20.

9. Express £1. 3s. 2¼d. as the decimal of £92. 15s.; and 3 cwt. 3 lb. as the decimal of 5 cwt. 1 qr. 12 lb.

10. Reduce 7 oz. 10 dwt. to the decimal of 10 lb.; and 26 yds. 1⅓ ft. to the decimal of 5 miles.

12. **1.** Convert $\frac{5}{41}$ and $\frac{4}{13}$ into recurring decimals, and find by simple inspection the vulgar fractions equivalent to the recurring decimals $\cdot\dot{5}$, $\cdot\dot{0}2\dot{7}$, $\cdot\dot{5}3\dot{4}$, $\cdot\dot{4}26\dot{3}$.

2. Reduce $\cdot 303\dot{5}$ and $\cdot 97\dot{3}$ to vulgar fractions in their lowest terms.

3. Add together $\cdot 1\dot{2}$, $\cdot 7\dot{8}\dot{9}$, $\cdot 5\dot{0}0\dot{1}$ and $\cdot 800\dot{2}\dot{0}$; and find the difference between $\cdot\dot{4}8\dot{1}$ and $\cdot 7\dot{2}$.

4. Divide $\cdot 00321$ by $\cdot 000011$; and express $\frac{65}{82}$ as a circulating decimal.

5. Multiply $\cdot\dot{0}8\dot{1}$ by $\cdot 925$; and $\cdot 12625$ by $\cdot\dot{9}50\dot{4}$.

6. Divide $\cdot\dot{0}\dot{4}$ by $\cdot\dot{7}6923\dot{0}$; and $\cdot 019\dot{4}$ by $1\cdot 1\dot{6}$.

7. Multiply $\cdot 12\dot{1}$ by 7642; and divide 1761 by $\cdot\dot{5}28\dot{3}$.

8. Simplify $\frac{14\cdot\dot{1}\dot{7}-13\cdot 02\dot{4}}{\cdot 07\dot{1}}$.

9. Find the value of $\cdot 8\dot{3}$ of 13s. 4d. + $\cdot 15\dot{8}$ of £1. 4s.; and express the result as the decimal of £5.

10. Reduce $\cdot\dot{9}\dot{0}$ of $2\cdot 1\dot{6}$ of half-a-crown to the decimal of $\cdot\dot{0}5\dot{4}$ of $1\cdot 1\dot{8}$ of £2. 10s.

B.

1. Express 3 kilometres 4 centimetres in millimetres; and 397900 centimetres in kilometres.

2. Find how many complete metres in 70605 centimetres, and express the remainder in millimetres.

3. Express 0·036 of 2 hectolitres in litres and centilitres; and 0·37 of 5 kilograms in milligrams.

4. Multiply 29 grams 37 centigrams by 300, and express the answer in kilograms; and divide 2 kilograms 270 grams 6 decigrams by 4, and express the answer in grams.

5. Find (in farthings) the value of 2 hectolitres 65 litres at 1600 farthings per hectolitre.

6. Express 8399 kilograms in tons to three places of decimals [1 lb. = 454 grams].

7. A metre (linear measure) is 39·3708 inches. Find to three places of decimals the number of acres in a hectare, which is 10000 square metres.

8. Find in (i) French money, (ii) English money (to the nearest penny) the total cost of 187·3 metres of cloth at 3·52 francs per metre, and 19·7 metres of cloth at 4·3 francs per metre [25 francs = £1].

9. Find in English money the price per gallon of liquid worth 8·25 francs per litre [1 litre = ·495 gallon; 100 francs = £4. 1s. 9d.].

10. Calculate whether posting at 1s. per mile is less or more expensive than posting at 65 centimes per kilometre [1 metre = 39·37 inches; 1 kilometre = 1000 metres; 100 centimes = 1 franc; 25 francs = £1].

14. 1. Find the cost of 4105 articles at £1. 17s. $4\frac{3}{4}$d.; and the cost of 7030 articles at £3. 18s. 9d. each.

2. Find the cost of 4827 articles at £17. 3s. $8\frac{1}{2}$d. each; and the cost of 1025 articles at £15. 13s. $9\frac{1}{4}$d. each?

3. Find the cost of (i) $785\frac{1}{2}$ articles at 13s. 4d. each; (ii) $693\frac{1}{4}$ articles at 15s. each; and (iii) $428\frac{3}{4}$ at 16s. 8d. each.

4. A gas consumer has three meters; one registers 10250 cubic feet, another 25500 cubic feet, and the third 27750 cubic feet. Find the amount of his gas bill at 3s. 9d. per 1000 cubic feet.

5. A labourer receives 3s. 7d. per day for every week day from 23rd February to 15th November, both days inclusive, and 2s. 10d. per day from 16th November to 22nd February inclusive. To how much do his wages amount in a year?

6. Find the value of (i) 75 articles at 15s. 2d. per dozen; (ii) 279 articles at 13s. $9\frac{1}{2}$d. per half-dozen; (iii) 85 articles at £1. 17s. 4d. per score; (iv) 3306 articles at £1. 13s. per gross.

7. Find the value of $68159\frac{1}{2}$ bushels of wheat at 26s. 4d. per quarter.

8. Find the cost of 7 tons 15 cwt. of bell metal £7. 16s per cwt.; and the cost of 3 cwt. 2 qrs. 10 lb. of tea at 2s. $4\frac{3}{4}$d per lb.

9. Find the value of 17440 articles at 14s. 9d. per dozen; and 36472 at £1. 11s. $10\frac{1}{2}$d. per score.

10. Make out in proper form and duly receipt a bill for 9 lb. of tea at $2\frac{1}{2}$d. per oz., 1000 eggs at 4 for $3\frac{1}{2}$d., 76 lb. of butter at £6. 10s. 8d. per cwt., 19 tons of coal at $8\frac{3}{4}$d. per cwt., $\frac{3}{4}$ cwt. of soap at 3s. 3d. per stone (14 lb.), 10 cwt. of rice at $2\frac{1}{2}$d. per lb.

15. 1. Find the value of steel rails weighing 127 tons 13 cwt 3 qrs. 14 lb. at £13. 10s. per ton.

2. Find the price of 3 acres 3 roods 25 perches of land at £120 per acre.

3. Find the cost of a fence 3 furlongs 9 poles $2\frac{3}{4}$ yards long at the rate of £205. 6s. 8d. per mile.

4. Find the cost of 17 oz. 10 dwt. 12 grains of plate at £1. 13s. 4d. per ounce.

5. Find the value of 3 cwt. 2 qrs. 21 lb. at £2. 6s. 8d. per ton.

6. Find the value of 12 qrs. 3 bush. 3 pecks of barley at £1. 1s. 4d. per quarter; and 4 gals. $3\frac{3}{4}$ pints of wine at 26s. per gallon.

7. What is the cost of 59 yards 1 foot $7\frac{1}{2}$ inches of silk at 5s. $10\frac{1}{2}$d. per yard?

8. Find the value of 44 acres 2 roods 25 perches of land at £55. 16s. $7\frac{1}{2}$d. per acre.

9. What is the value of a gold cup weighing 9 oz. 8 dwt. 19 grains, when gold is worth £3. 17s. $10\frac{1}{2}$d. per ounce?

10. Make out in proper form and duly receipt a bill for 26 gals. 2 qts 1 pint of wine at 19s. 2d. per gall., 1 qr. 26 lb. 8 oz. of cheese at £3. 10s. per cwt., 3 barrels of candles, each 4 cwt. 56 lb., at £3. 6s. 8d. per cwt.

16. 1. If 60 yards of material cost £1. 17s. 6d., what will 171 yards of the same material cost?

2. If 19 lb. 7 oz. of sugar cost 6s. $5\frac{3}{4}$d., what will 3 cwt. 1 qr. 5 lb. 5 oz. cost?

3. If 15 acres 3 roods 24 poles of land cost £323. 6s., what is the price per acre?

4. If 49 articles cost 10s. $2\frac{1}{2}$d., how many of the same kind can be bought for £8. 18s. $7\frac{3}{4}$d.?

5. If 20 tons of goods, worth 20 guineas per ton, be exchanged for 35 tons of other goods, what are the latter goods worth per ton?

6. If for £1. 11s. 6d. a package weighing 10 cwt. 80 lb. can be carried 36 miles, what weight ought to be carried 24 miles for the same money?

7. If 2 tons 2 cwt. 3 qrs. are carried 3 miles for 18s. $9\frac{3}{4}$d., how far ought 6 cwt. 3 qrs. to be carried for the same money?

8. What time should 24 men take to finish some work of which 18 men have done one-half in 15 days?

9. A cyclist, riding at the rate of 12 miles an hour, starts at 4 p.m. to overtake a pedestrian walking at the rate of 4 miles an hour, and who started at noon. At what time will the pedestrian be overtaken?

10. A clock which gains $1\frac{1}{2}$ minutes in 24 hours is 5 minutes slow at 10 o'clock on Monday morning. When will it show true time?

7. 1. If 12 men complete a piece of work in 36 hours, how many men will do twice as much in 27 hours?

2. If 24 boys complete a piece of work in 10 days of 8 hours each, how many boys will do three times as much in 12 days of 10 hours each?

3. If 6 men can build a wall 80 feet long and 4 feet high in $5\frac{1}{3}$ days, how many men must be employed to build a wall 65 feet long and 5 feet high in $3\frac{1}{4}$ days?

4. Find the number of days in which 13 men would earn £52, working 8 hours a day, if 26 men earn £104 in 5 days, working 10 hours a day.

5. A builder's contract can be completed by 20 men working 6 days per week and 8 hours per day in 14 weeks. How many hours per day must 24 men work to fulfil the contract in 16 weeks, working only 5 days per week?

6. If 3 cwt. 3 qrs. 14 lb. are carried $104\frac{1}{2}$ miles for £1. 14s. 10d., what weight ought to be carried 93 miles for £4?

7. A garrison of 1800 men have provisions for 12 weeks. How long will the provisions last if 600 more men are introduced, but the daily allowance per man is diminished by one-third?

8. If 100 parcels weighing 2 lb. each can be carried 300 miles for $4\frac{1}{2}$d. apiece, what will be the total charge for carrying 200 parcels twice as heavy as the former for a distance of 175 miles?

9. If one man walks 72 miles in 8 days, how far will another man walk in 5 days, if the first man walks 3 miles in the same time that the other man walks 4 miles?

10. If 12 sheep or 18 lambs can eat 45 bushels of turnips in 9 days, how long will it take 20 sheep and 15 lambs to eat the same number of bushels?

18. 1. Divide £17. 6s. 3d. in the proportion of 2, 5, 8; and divide £31. 12s. in the proportion of $\frac{1}{6}$, $\frac{2}{5}$, $\frac{3}{4}$.

2. Three boys with 40, 72, and 96 marbles respectively played together, and won 104 marbles, agreeing to divide the gains proportionally. What will be the share of each?

3. A father divides £504 amongst his three sons, whose ages are 19, 21, and 23, in sums proportional to their ages. Three years afterwards he similarly divided an equal sum. How much did each receive altogether?

4. Three persons invested £9410, £3674, and £5216 respectively in a business, in which the net profit for a year was £1448. 15s. How should this money be divided?

5. The net profits of a business amounting to £2689. 8s. are divided among the four partners, whose contributions to the capital were respectively £543. 10s., £274. 10s., £685. 13s. 4d., and £417. 6s. 8d. How much will each partner receive?

6. A grocer starts business with £2000. Six months later he admits a partner with £3000. What is each man's share of the year's profit of £850?

7. A, B, and C rent a field for £5. 12s. 6d. per annum, and pay a sum proportional to the use each makes of it. If A feeds on it 6 cows for 8 months, B 9 cows for $6\frac{1}{2}$ months, and C 7 cows for $10\frac{1}{2}$ months, what should each pay of the rent?

8. A, B, and C start in business. A invested £500, and after 4 months increased his capital to £700; B invested £600, and after 9 months reduced his capital to £500; C invested £700. How should a year's profit of £343. 10s. be divided?

9. A can reap in 8 days a field which takes B 9 days to reap. They work together at harvest and earn £22. 10s. 6d. between them; if they share the money in proportion to the work they have respectively done, what should each receive?

10. Two men own adjoining farms of 360 and 540 acres respectively. They unite the farms and take a partner, who pays them £2000 on the understanding that a third share of the land shall in future belong to each. How is the £2000 to be divided between the original owners?

19. **1.** The sum of £463. 16s. is to be raised in a parish, the assessment of which is £6184. What is the rate in the £?

2. If a bankrupt pays £2204. 4s. 8½d. upon debts amounting to £3245. 10s., what is the dividend in the £?

3. Find the dividend on £2525 at 3s. 2½d. in the £.

4. A bankrupt's assets are £1209. 13s. 9d., out of which he can pay his creditors 12s. 3d. in the £. What will be the total amount that his creditors will lose?

5. A bankrupt owes three creditors £290, £556, and £620 respectively; his property is worth £412. 6s. 3d. What does he pay in the £, and what does each creditor receive?

6. A bankrupt can pay 15s. 9d. in the £, but if his assets were £500 more he could pay 16s. 6d. Find his assets.

7. A person's net income after paying income-tax at 1s. 4d. in the £ is £592. 13s. 4d. Find the gross income on what he pays tax.

8. If a bankrupt's creditors lose 4s. 9d. in the £, and the assets are valued at £894. 8s. 3d., what are his liabilities?

9. The income-tax being increased from 8d. to 1s. 2d. in the £, a person pays £37 more income-tax than before. Find his income.

10. A person's income is reduced from £430. 10s. to £405 7s. 9d. by paying income-tax. What is the tax in the £?

20. 1. A property worth £4500 is owned by three persons; one owns $\frac{2}{5}$ and one $\frac{1}{3}$. Find the third person's share.

2. A man spent $\frac{1}{10}$ of his money, and then $\frac{1}{6}$ of the remainder, and had £33. 15s. left. How much had he at first?

3. If A can do a piece of work in 9 days, B in 12 days, and C in 16 days, in how many days could they do it, working together?

4. A hot-water pipe can fill a bath in 5 minutes; a cold-water pipe can fill it in 3 minutes; and a waste pipe empties it in $7\frac{1}{2}$ minutes. If all the pipes are opened, in how many minutes will the bath be filled?

5. One-fifth of a field is meadow, three-eighths are arable, and the remainder measures 1 acre 3 roods 26 perches. Find the area of the meadow and arable parts respectively.

6. Two men together can do a piece of work in 1 hour. One of them alone takes 3 hours; how many hours will it take the other to do it alone?

7. A can do a piece of work in $7\frac{1}{3}$ days, B in $6\frac{2}{7}$ days, C in $6\frac{1}{9}$ days. A and B work together for 2 days; how many days would it take C alone to finish?

8. A man has a share in a mine, $\frac{1}{5}$ of which he sells to A and $\frac{1}{4}$ of the remainder to B. He still owns $\frac{3}{8}$ of the mine; how much was his share originally?

9. After spending $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{4}{7}$ of the money in her purse, a woman finds that she has just enough left to buy $9\frac{3}{5}$ dozen oranges at the rate of 4 for 3d. How much money had she in her purse at first?

10. A alone can do a piece of work in 5 days, and B in 6 days, working 11 hours a day. Find in how many days A and B can reap it together, working 10 hours a day.

21. 1. What percentage of £32. 10s. is £1. 14s. 1½d.

2. Express 6 per cent. of 5 cwt. 2 qrs. 9 lb. in qrs., lb., and oz.

3. A school contains 380 boys; 5 per cent. are between the ages of 15 and 17; 10 per cent. between the ages of 13 and 15; 35 per cent. between 11 and 13, and the remainder under 11. Find the number of each class.

4. On a tour of 30000 miles a traveller went 24375 miles by sea. What percentage of his tour did this amount to?

5. If 6500 shots are fired at a target and 1365 strike it, what is the percentage of hits?

6. The population of a town increased from 6705 in 1891 to 7152 in 1901. Find the percentage of increase during that period.

7. If a tradesman takes £11. 4s. 3d. ready money for an account rendered at £11. 10s., what per cent. does he remit?

8. Instead of using a correct lb.-weight, one which weighs only 15·75 oz. is used; to what extent per cent. are customers defrauded?

9. Between 1891 and 1901 the population of a certain town increased by 24 per cent., and in the last-named year amounted to 62093. What was the population in 1891?

10. Two pieces of ore weighed 12 lb. and 18 lb. (avoir.) respectively, and the two contained 1½ lb. of silver. If the larger piece contained 6 per cent. of silver, what per cent. of silver did the smaller contain?

22 **1. A** tradesman deducts $4\frac{1}{2}$ per cent. from a bill of £52. 10s. for ready money. What is the amount of the discount?

2. A merchant buys goods to the amount of £686. 13s. 4d. If from this sum he is allowed a discount of $4\frac{3}{4}$ per cent., what does he actually pay?

3. What would it cost to insure furniture valued at £725 if the rate charged is 2s. per cent.?

4. If 5000 articles are sold at 2s. 3d. each and $7\frac{1}{2}$ per cent. discount is to be allowed for cash payment, how much money will the seller actually receive?

5. If an auctioneer's commission for the sale of goods is $7\frac{1}{2}$ per cent. and he receives £4. 2s. 6d., what were the goods sold for?

6. What sum of money must a person bequeath to a relative in order that the latter may receive a sum of £2350 after a legacy duty of 6 per cent. has been deducted?

7. A grocer buys 10 tons of currants at the rate of $5\frac{7}{8}$d. per lb., and is allowed a discount of $2\frac{3}{4}$ per cent. for cash. What is the total amount of discount he receives?

8. If a tradesman can insure his stock at the rate of 1s. $5\frac{3}{4}$d. per cent. per month, what annual premium should he pay on £1000 worth of goods?

9. The value of a ship is £25000, and the insurance premium is 2 per cent. For how much should the ship be insured so as to cover both value and premium?

10. A merchant insures a ship and cargo for £15320 at a premium of $4\frac{1}{4}$ per cent. to cover the value of the ship and the cost of insurance. Find the premium paid and the value of ship's cargo.

23. 1. A grocer bought 6¼ cwt. of tea for £93. 6s. 8d. and sold it so as to gain a profit of 25 per cent. At what price per pound did he sell it?

2. A builder buys a piece of land for £476. 18s. and builds a house upon it at a further cost of £1047. 2s. If he sells the house and land for £1905, what percentage will he gain on the whole outlay?

3. If goods are retailed at 3s. 6d. each, what must have been the cost price per hundred to realise a profit of 5 per cent.?

4. A mixture is made of two kinds of sugar worth 4d. and 6½d. per lb. respectively by taking 3 lb. of the first to 2 lb. of the second. At what price per lb. must the mixture be sold to gain a profit of 20 per cent.?

5. A farmer loses 12 per cent. by selling wheat at 22s. per quarter. How much per cent. would he gain or lose by selling it at 24s. 6d. per quarter?

6. By selling a house for £994. 10s. a builder gained 17 per cent. on his outlay. What would he have received if he had lost 17 per cent. on his outlay?

7. A sold a horse to B, gaining 7½ per cent. on what it cost him; B sold it to C for £70. 19s., gaining 10 per cent. on what it cost him. What did A pay for the horse?

8. A tradesman marks his goods at 20 per cent. above cost price. He allows a customer 2½ per cent. on his bill; what rate of profit per cent. does he make on his outlay?

9. A shopkeeper who is selling off makes a reduction of 10 per cent. from the marked price. At what price should he mark an article for which he is to receive £1. 11s. 6d.?

10. By accepting A's offer for land recently purchased a speculator would lose 7 per cent. on the purchase money. By accepting B's offer he would gain 5 per cent. If B offers £273. 12s. more than A, find what the speculator paid for the land.

24. 1. Find the simple interest (i) on £5982. 7s. 6d. for 4 years at $3\frac{3}{4}$ per cent. per annum; and (ii) on £1226. 9s. 2d. for 5 months at £3. 12s. per cent. per annum.

2. What principal is required to produce £225. 1s. 6d simple interest in 3 years at 5 per cent.?

3. Find the interest on £750 from March 3rd to July 27th at $5\frac{1}{2}$ per cent. per annum.

4. If in 4 years £537. 16s. 8d. invested at simple interest amounts to £591. 12s. 4d., what is the rate of interest per cent.?

5. In what time will £250 double itself at $2\frac{1}{2}$ per cent. simple interest?

6. What sum invested at 5 per cent. per annum simple interest will produce in 4 years the same amount of interest as £250 lent at 3 per cent. would produce in 6 years?

7. Find, to the nearest penny, the compound interest on (i) on £2580 for 3 years at $4\frac{1}{2}$ per cent. per annum; (ii) £625. 4s. for 3 years at 4 per cent. per annum.

8. Find, to the nearest penny, the sum to which £1760 will amount at 5 per cent. per annum compound interest for $2\frac{1}{2}$ years, the interest being payable half-yearly.

9. If three years' interest on a sum of money lent at 5 per cent. per annum compound interest is £189. 3s., find the sum lent.

10. What sum of money lent at 5 per cent. compound interest will in 3 years amount to twice as much as £342. 11s. 3d. lent for 5 years at $4\frac{1}{2}$ per cent. simple interest?

5. 1. What is the present value of £1593. 15s. due 15 months hence at 5 per cent. per annum simple interest?

2. What is the true discount on £107. 5s., payable 6 months hence at $3\frac{1}{2}$ per cent. per annum?

3. Find the true discount on a bill of £1249. 10s., drawn 4th February for six months, and discounted 11th March, at 5 per cent. per annum

4. If the true discount on a bill due 9 months hence at 4 per cent. per annum is £6. 15s., for what amount is the bill drawn?

5. What is the difference between true discount and ordinary trade or banker's discount. Find both on £772. 10s. due 8 months hence at $4\frac{1}{2}$ per cent. per annum.

6. The difference between the trade discount and true discount on a bill due 2 months hence at $2\frac{1}{4}$ per cent. is 1s. $8\frac{1}{4}$d. Find the amount of the bill.

7. Which would be the more advantageous — to sell goods for £810 ready money, or for £830 to be paid 9 months hence, discount being at the rate of 5 per cent. per annum?

8. A man has a bill for £733. 6s. 8d., due $4\frac{1}{2}$ months hence. What would a broker give him for it, the rate of discount being $4\frac{1}{4}$ per cent. per annum?

9. What is the banker's discount on a bill for £310. 5s., drawn 2nd April at 4 months, and discounted 6th June, at 5 per cent. per annum, allowing the usual three days of grace?

10. A bill for £150. is drawn 22nd May at 3 months, and discounted on 1st July at $4\frac{3}{4}$ per cent. per annum. What does the holder of the bill receive, to the nearest penny? (The usual three days of grace are to be allowed for.)

N.B.—*Brokerage is allowed for in every case.*

26. 1. Find the income derived from an investment of £833. 5s. in 3 per cent. Local Loans stock at 101.

2. If £9250 is invested in $3\frac{1}{4}$ per cent. stock at $7\frac{1}{2}$ below par, how much stock is purchased, and what will be the annual income derived from it?

3. How much must be invested in $3\frac{1}{2}$ per cent. Colonial Municipal stock at $99\frac{3}{4}$ to realise an income of £350 per annum; and what amount of stock will the investor hold?

4. Which is the better investment, $3\frac{1}{2}$ per cent. Cape Town debentures at 98 or 4 per cent. Durban debentures at 108; and how much per cent.?

5. At what price must a person invest in 3 per cent. Corporation stock to receive £3. 4s. per cent. for his money?

6. If $3\frac{1}{2}$ per cent. stock is at 91, find the difference in the income derived from £7800 stock and the investment in stock of £7800 sterling.

7. A trustee has £7890 to invest: with £4301 he buys 3 per cent. Colonial Government stock at $93\frac{1}{2}$; with the rest he buys Hampshire County 3 per cent. stock at 97. How much of each stock will he hold, and what will be the income from each investment?

8. A person invested £3564 in $2\frac{3}{4}$ per cent. Consols at 99. How much stock, at the same price, could be bought with the first quarterly instalment of interest?

9. A capitalist has £17500 in 3 per cent. Corporation inscribed stock. He sells out at $96\frac{1}{4}$ and reinvests in $4\frac{1}{2}$ per cent. Railway debentures at $134\frac{3}{4}$; how much is his income increased?

10. A person has £3000 of 4 per cent. Railway debentures which he sells out at 120. He invests £1900 in $2\frac{3}{4}$ per cent. Consols at 95, and the remainder in 3 per cent. London County Consolidated stock at par; by how much is his income altered?

7. 1. Find the square root of 552049 and 17089956.

2. Find the square root of 1·002001 and 1907·855041.

3. Find the square root of $1\frac{72}{289}$ and $154751\frac{77}{169}$.

4. Find the square root of 19 and ·0068 to three places of decimals.

5. A square court was covered with 136161 tiles, each tile measuring 16 square inches. What was the length in yards of each side of the court?

6. Find the length of the side of a square enclosure, the paving of which cost £27. 1s. 6d. at 8d. per square yard.

7. If a square plot of ground covers 961 square yards, how many palings placed a yard apart will be required to go round it?

8. What is the cost, to the nearest penny, of putting a fence round a square field, whose area is two acres, at 3s. 6d. per yard.

9. A square lawn has an area of 1 acre 6 perches $19\frac{1}{2}$ square yards. Find (i) the length of its side; (ii) the cost of turfing it at 3d. per square foot.

10. How long will it take a man to walk round a square field, whose area is 40 acres, at the rate of 4 miles an hour?

28. 1. How many square yards and square feet of linoleum will be required to cover the floor of a passage 12 ft. 8 in. long and 4 ft. 6 in. wide?

2. Find the area of a courtyard 59 ft. 4 in. long and 48 ft. 9 in. wide, and the cost of paving it at 4s. 6d. per square yard.

3. What is the rent, at £1. 13s. per acre, of a rectangular field which measures 60 poles in length and 10 poles 1 yard in breadth.

4. How many planks, 12 ft. long and 6 in. wide, will be required to floor a room 20 yds. long and 15 yds. wide?

5. Find how many yards of carpet, 27 in. wide, will cover a room 24 ft. 6 in. long by 18 ft. wide; and its cost at 4s. 6d. per yard.

6. How many square yards of floor-cloth will cover a room 38 ft. 3 in. long and 25 ft. 6 in. wide, if a margin of 9 in. in width is left uncovered all round the room?

7. Find the cost, at 2s. per square yard, of staining a border, 18 in. wide, on the floor of a room 22 ft. 6 in. long by 13 ft. 5 in. wide.

8. Find the expense of glazing a window containing 16 panes, each 1 ft. 2 in. long and 10 in. wide, at 4s. 6d. per square foot.

9. A path 4 ft. wide is made along two sides and one end of a rectangular lawn. The sides of the lawn inside the path measure 15 yds. 1 ft. 6 in., and the ends measure 12 yds. Find the area of the path.

10. A square pond whose side measures 75 ft. is surrounded with a path $2\frac{1}{2}$ yards wide. Find the area of this path, and the cost of asphalting it at 9d. per square yard.

29. 1. Find, in square feet, the whole area of the four walls of a room 15 ft. 9 in. long, 13 ft. 6 in. wide, and 12 ft. high.

2. Find the cost of painting a room 16 ft. 7 in. long, 14 ft. 2 in. wide, and 9 ft. high at 1s. $7\frac{1}{2}$d. per square yard.

3. Find the cost of painting a room 22 ft. long, 17 ft. wide, and 13 ft. high at 6d. per sq. ft., allowing for an area of 36 sq. ft. occupied by doors and windows.

4. How many yards of paper 2 ft. wide would be required for the walls of a room 18 ft. long, $16\frac{1}{2}$ ft. broad, and 12 ft. high?

5. Find the cost of papering a room 20 ft. long, $16\frac{1}{2}$ ft. wide, and 12 ft. high, the price of a piece of paper 12 yds. long and $\frac{3}{4}$ yd. wide being 4s. 6d.

6. A room is $22\frac{1}{2}$ ft. long, 15 ft. wide, and 12 ft. high. Find the cost of painting the ceiling at 1s. 6d. per square yard, and painting $\frac{3}{4}$ths of the surface of the walls at 2d. per square foot.

7. A room is 21 ft. long, 13 ft. 6 in. wide, and 10 ft. 6 in. high, and has a door-way 7 ft. $7\frac{1}{2}$ in. by 4 ft., three windows 10 ft. by 4 ft. each, and a fireplace 4 ft. square. Find the cost of painting the walls at 6d. per square yard.

8. Find the cost of the paper for the walls of a room 30 ft. 6 in. long, 21 ft. 4 in. wide, and 10 ft. 6 in. high, the paper being 1 ft. 9 in. wide, at 1s. 9d. per piece of 12 linear yds., allowing 250 sq. ft. for windows, doors, etc.

9. A room is 27 ft. long, 24 ft. wide, and 18 ft. high. There is a wainscot 6 ft. high all round, costing 1s. 8d. per sq yd. The remaining wall space is covered with paper 28 in. wide, costing 1s. 2d. per yard. Find the total cost.

10. Find the total cost of papering the walls of two rooms, both 13 ft. 6 in. high; the former is 16 ft. long and 14 ft. wide, and the latter 14 ft. long and 12 ft. wide; the paper is 1 ft. 9 in. wide, and costs 2s. 9d. per piece of 12 yards, with an additional charge of 9d. per piece for hanging.

30. 1. How many cubic feet of space would a box 3 ft. 4 in. long, 2 ft. 6 in. wide, and 2 ft. 3 in. deep occupy?

2. Find how many cubic yards of earth can be excavated from a rectangular pit 22 ft. long, $4\frac{1}{2}$ yds. wide, and 2 ft. 6 in. deep; and the cost of the labour at 1s. 3d. per cubic yard.

3. Find how many bricks, each 9 in. long, $4\frac{1}{2}$ in. wide, and 3 in. thick, are contained in a wall 50 yds. long, $6\frac{3}{8}$ ft. high, and 1 ft. $1\frac{1}{2}$ in. thick; and the cost of the bricks at 25s. per 1000.

4. What is the cost of flooring a room consisting of 36 planks, each $10\frac{1}{2}$ ft. long, 8 in. wide, and 3 in. thick, if a cubic foot of the timber is worth 1s. $7\frac{1}{2}$d.?

5. A beam of wood contains 24 cub. ft. 8 cub. in.; its length is 20 ft. 4 in., and its width 1 ft. 5 in. Find its thickness.

6. A man tries to pack in a case, 5 ft. 3 in. long, 3 ft. wide, and 2 ft. 9 in. deep, 100 dozen books, each of which is $10\frac{1}{2}$ in. long, $4\frac{1}{2}$ in. wide, and $1\frac{3}{8}$ in. thick. How many books must he leave out?

7. If a cubic foot of water is equal to 6·25 gallons, find the number of gallons of water contained in a cistern 4 ft. long, $2\frac{1}{2}$ ft. wide, and 3 ft. deep.

8. Find the whole surface of a rectangular block of wood 3 ft. 6 in. long, 8 in. wide, and $4\frac{1}{2}$ in. thick.

9. Find the cost of painting the four sides and the bottom of a tank 2 yds. long, 4 ft. wide, and $3\frac{1}{2}$ ft. deep, at 3d. per square foot.

10. If a cubic foot of water weighs 1000 ounces, and mercury is 13·6 times as heavy as water, what weight of mercury can be contained in a tank 20 ft. long, 8 ft. wide, and 7 ft. deep?

31. 1. What sum added to seventy thousand six hundred and five will make one million three hundred and forty thousand and two? Write the result in words.

2. Multiply 73948 by 60007.

3. Divide 2779845 by 231 by the method of short division by factors. [$11 \times 7 \times 3 = 231$.]

4. What number multiplied by 567 is equal to 3822714?

5. Multiply £28. 15s. 9½d. by 265.

6. There was formerly a gold coin in circulation called a half-guinea (10s. 6d.). Find the value of 3573 half-guineas in pounds, shillings, and pence.

7. Find how many times a bicycle wheel, measuring 55 inches round, would turn in $48\frac{3}{4}$ miles (1760 yards = 1 mile).

8. At Christmas a present of $\frac{1}{2}$ lb. of tea was given to 3200 old women and $\frac{1}{4}$ lb. of tobacco to 1664 old men. Find the total weight in cwt.

9. (i) Add together $\frac{3}{4}$, $\frac{5}{6}$, $1\frac{9}{14}$, and $\frac{11}{24}$.
(ii) Multiply $10\frac{2}{35}$ by $2\frac{5}{6}$.
(iii) What number multiplied by $3\frac{3}{4}$ will make 29?

10. Make out a stationer's bill for the following articles; show how it should be receipted, and say how much change there will be after payment with a £50 note: 17 blotting cases, at 2s. 11¼d. each; 13 photographic albums, at 17s. 6d. each; 2½ dozen rulers, at 4½d. each; a gross (12 dozen) of reward books, at 1s. 11½d. each; 3 dozen and 9 inkstands, at 1s. 6d. each.

32. 1. Add together five hundred thousand and thirty, three hundred thousand eight hundred and three, two hundred and nine thousand and ninety-seven, and eleven million eleven thousand and eleven. Write the result in words.

2. Multiply 79385 by 967.

3. Divide 2126783 by 528 by the method of short division by factors. [$11 \times 12 \times 4 = 528$.]

4. What is the divisor when 587 is the quotient and 3523174 is the dividend?

5. Multiply £57. 11s. 6d. by 648.

6. How often is £49. 16s. $8\frac{1}{2}$d. contained in £16196. 10s. $2\frac{1}{2}$d.?

7. A grocer bought six hogsheads of sugar, each weighing 12 cwt. 1 qr. 6 lb.; after selling 18 cwt. 3 qrs. 17 lb. 8 oz. to one customer, 17 cwt. 2 qrs. 14 lb. 4 oz. to another, and 15 cwt. 3 qrs. 15 lb. 12 oz. to a third, what quantity had he left?

8. How often will a clock tick from the beginning of March 1st up to noon on Christmas Day, assuming it ticks every second?

9. (i) From $17\frac{13}{25}$ subtract $14\frac{9}{15}$.
(ii) Multiply $1\frac{13}{15}$ by $8\frac{7}{16}$.
(iii) Divide $64\frac{1}{2}$ by $2\frac{1}{10}$ of $7\frac{1}{8}$.

10. Make out a stationer's bill for the following articles; show how it should be receipted, and say how much less than 6 guineas will be sufficient to settle the bill: $4\frac{1}{2}$ reams of paper, at 5s. 11d. per ream; $3\frac{1}{2}$ gross of penholders, at $2\frac{3}{4}$d. per dozen; 13 dozen drawing books, at $4\frac{1}{2}$d. each; 17 boxes of chalk, at 1s. $1\frac{1}{2}$d. each; 23 pieces of indiarubber, at $1\frac{1}{4}$d. per piece.

33. 1. From one hundred and one thousand and ten subtract eleven thousand and twenty-one. Write the result in words.

2. By how much is seventeen times eleven hundred and eighty-nine greater than thirteen times one thousand and seventy-eight?

3. By what number must 325 be multiplied to make two millions fifty-six thousand two hundred and seventy-five?

4. A shopkeeper bought thirteen gross of tin articles for £32. 8s. 9d. and sold them at $6\frac{1}{2}$d. each. What was his profit?

5. A farmer sold 152 sheep at a fair; with the money he bought 19 cows at £19. 7s. 4d. each, and then had £10. 2s. 8d. left. What price did he get on an average for each sheep?

6. By the method of short division by factors find the thirty-sixth part of £845. 17s. 9d.

7. A grocer bought a chest of tea weighing 4 cwt. 2 qrs. 26 lb. How many half-pound parcels can he sell?

8. If the sun rises at 3·45 a.m. and sets at 8·19 p.m., how many minutes is it above the horizon and how many below?

9. Find the value of—

(i) $7\frac{7}{8} - 5\frac{1}{5} + 8\frac{1}{6} - 4\frac{3}{4}$.

(ii) 32 divided by $14\frac{2}{5}$.

(iii) $\frac{7}{11}$ of $3\frac{3}{8} \times 1\frac{1}{13}$ of $3\frac{1}{3}$.

10. Make out an invoice for the following goods, and say how much less than 20 guineas will be sufficient to settle the account: 5 barrels each containing 165 lemons, at 3 for $2\frac{1}{2}$d.; 3 boxes each containing 250 oranges, at $4\frac{1}{2}$ per dozen; 2 barrels each containing 58 bunches of grapes, at 1s. 4d. each; 4 barrels each containing 100 lb. of potatoes, at $1\frac{1}{4}$d. per lb.; and 8 barrels of apples each containing 475, at 3s. 6d. per hundred.

34. 1. What number must be taken from one million twenty thousand and twenty to leave two hundred and ninety thousand two hundred and nine? Write the result in words.

2. Multiply 70504 by thirteen thousand and forty-five.

3. By the method of short division by factors, find how many times 105 is contained in 73436, and explain how the remainder is ascertained. [$3 \times 5 \times 7 = 105$.]

4. Find the value in sovereigns of 682560 halfpence.

5. Express 2181240 seconds in weeks, days, hours, and minutes.

6. How many yards of velvet at 14s. $0\frac{3}{4}$d. per yard would be worth 600 yards of silk at 11s. 3d. per yard?

7. If 2 tons 5 cwt. 38 lb. of groceries are made up as far as possible into 10 lb packages, how many packages will there be, and what quantity of groceries will be left?

8. An apprentice in Portsmouth Dockyard receives 4s. per week during his first year of service, 6s. in the second year, 8s. in the third, 10s. in the fourth, 12s. in the fifth, and 14s. in the sixth. How much does he receive altogether in the six years, and how much on an average per week for the six years? (52 weeks = 1 year.)

9. (i) Add $\frac{1}{4}$ to $\frac{5}{12} + \frac{4}{15}$.
(ii) Divide $\frac{7}{13}$ by $\frac{5}{6}$.
(iii) How many times is $\frac{7}{33}$ contained in $3\frac{3}{5}$ of $4\frac{2}{7}$?

10. Make out an invoice for the following goods, and say how much less than 60 guineas will be sufficient to settle the account: 37 yards of cloth, at 1s. $9\frac{1}{2}$d. per yard; 29 yards of silk, at 10s. $4\frac{1}{2}$d. per yard; 42 dozen reels of cotton, at $7\frac{1}{4}$d. per dozen; 73 gross of knitting-needles, at 11s. $6\frac{1}{2}$d. per gross; 54 pieces of tape, at 2 pieces for $1\frac{3}{4}$d.; 130 cards of darning cotton, at $\frac{3}{4}$d. each.

35. 1. By how much is sixty thousand five hundred and fifty-five less than one million five hundred thousand five hundred? Write the result in words.

2. Multiply 8035 by six thousand five hundred and nine.

3. By the method of short division by factors find the sixty-fourth part of £3191.

4. What is the difference in value between a million farthings and a thousand guineas?

5. How many times can a pint measure be filled from a bin containing 1 quarter 2 pecks 3 quarts of peas?

6. If 324 articles cost £94. 10s., how much is this per dozen?

7. A shopkeeper laid out £14. 5s. 9d. on gloves, at 2s. 3d. per pair; some of them faded and were unsaleable, the rest he sold for £18. 11s. 3d. at 3s. $4\frac{1}{2}$d. per pair. How many pairs faded?

8. In what time could a person, walking at the rate of 88 yards per minute, travel 7 miles?

9. (i) Add $\frac{1}{4}$, $\frac{1}{8}$, $\frac{5}{8}$, and $\frac{7}{10}$.
(ii) Subtract $9\frac{2}{15}$ from $12\frac{1}{15}$.
(iii) Express $\frac{\frac{2}{27}\frac{6}{7}}{\frac{1}{14}\frac{8}{14}}$ in its simplest form

10. Make out an invoice for the following goods, and say how much change there will be after payment with a £5. note: $7\frac{3}{4}$ lb. of butter, at 1s. 7d. per lb.; $9\frac{1}{2}$ lb. of tea, at 2s. 4d. per lb.; $13\frac{1}{2}$ lb. of sugar, at $2\frac{1}{2}$d. per lb.; 7 lb. of cheese, at 1s. $1\frac{1}{2}$d. per lb.; $4\frac{1}{2}$ lb. of raisins, at $5\frac{1}{2}$d. per lb., and 19 jars of marmalade, at 18s. per dozen.

36. 1. By how much does one million forty thousand five hundred and six fall short of one million four hundred and five thousand and sixty? Write the result in words.

2. Multiply 674319 by the factors of 84.

3. How many packets of tea, each weighing 2 lb. 4 oz., can be made with 4 cwt. 3 qrs. 1 lb. 4 oz.?

4. What is the difference between four thousand six hundred and ninety-six pence and two hundred and fifty-seven half-crowns?

5. Multiply £348. 19s. $6\frac{3}{4}$d. by 756.

6. How many yards of wire netting at $3\frac{1}{2}$d. per foot can be bought for £6. 7s. 9d.?

7. A sum of £657. 9s. $9\frac{1}{2}$d. is divided among 68 persons, so that one receives four times as much as each of the others. Find the shares.

8. The fore wheel of a carriage is 8 feet round, and the hind wheel is 11 feet; how many turns will one make more than the other while the carriage travels 3 miles?

9. (i) Add together $2\frac{4}{5}$, $3\frac{7}{12}$, and $5\frac{11}{20}$.
(ii) Subtract $6\frac{7}{18}$ from $7\frac{5}{18}$.
(iii) How many times is $1\frac{27}{28}$ contained in $5\frac{5}{98}$?

10. Make out an invoice for the following goods, and say how much less than £25 will be sufficient to settle the account: 1 dozen pairs of socks, at 2s. $10\frac{1}{2}$d per pair; $5\frac{1}{2}$ yards of flannel, at 1s. $10\frac{1}{2}$d. per yard; $7\frac{1}{4}$ yards of serge, at 2s. 4d. per yard; 4 dozen and 4 pairs of gloves, at 2s. 6d. per pair; 15 collars, at 7s. per dozen; 3 pieces of silk, each $19\frac{3}{4}$ yards, at 4s. 3d. per yard.

7. 1. In a division sum the divisor is 307, and the quotient is 835, the remainder being 296; what is the dividend?

2. If 10 tons of coal cost £11. 10s., find to the nearest penny the value of a cwt.

3. In 57223 lb. (avoirdupois) how many tons, cwt., qrs., lb.?

4. If 4 tons 17 cwt. 1 qr. of goods cost £12. 19s. 4d. what weight of the same kind of goods will £2. 13s. 4d. buy?

5. A train travels at the rate of $34\frac{1}{2}$ miles in 45 minutes. In how many hours does it travel 161 miles?

6. Fifteen men are occupied for 40 days in building a wall; how many men would be required to build the same wall in 24 days, and what will be the cost for labour if each man is paid 6s. 6d. per day?

7. Find, by Practice, the value of 1154 truck loads of coal at £5. 17s. 4d. per truck load.

8. Add together $\frac{2}{7}$, $\frac{7}{15}$, $\frac{9}{20}$, and $\frac{19}{21}$; and subtract $3\frac{17}{24}$ from $5\frac{1}{3}$.

9. Simplify $8\frac{1}{7}$ of $2\frac{4}{19} \div (4\frac{2}{7} \div \frac{5}{28})$.

10. (i) Write down the series of fractions (their denominators being powers of 10) which is equivalent to the decimal ·3125.
(ii) Multiply 13·6 by 0·0405.
(iii) Divide 25·3 by 0·0275.

38. 1. What number must be added to 2702719 to give a sum exactly divisible by 447?

2. A bill amounting to £16. 6s. 8d. was paid with a certain number of sovereigns, three times as many shillings, and four times as may pence. Find the number of each coin used.

3. In 206046 linear inches how many miles, furlongs, yards, feet, inches?

4. After deducting 3 roods 2 perches $29\frac{1}{2}$ square yards, for making a road, an estate containing 31 acres is divided into 40 building sites of equal size. Find the area of each site.

5. If 12 yards of silk cost £7. 13s., how many yards can be bought for £16. 11s. 6d.?

6. A shopkeeper bought 374 eggs at 2 a penny, and some at 3 for twopence. He paid altogether £1. 9s. 11d.; how many eggs did he buy at 3 for twopence?

7. Find, by Practice, the cost of 1825 articles at £2. 17s. 10d. per score.

8. Add together $4\frac{2}{3}$, $5\frac{1}{8}$ and $3\frac{5}{12}$; and subtract $2\frac{1}{20}$ from $4\frac{1}{8}$.

9. Simplify $(4\frac{1}{16}$ of $2\frac{6}{13}) \div (3\frac{1}{12} + 5\frac{1}{6} - 8\frac{2}{3})$.

10. (i) Add together 20·09, 6·81, 0·123 and 0·097; and subtract the sum from 30·0012.
(ii) Multiply 3·096 by 0·075.
(iii) Divide 0·9648 by 0·096.

9. 1. By what number must 70690 be multiplied so that, when the product is subtracted from thirty millions, the result is 1158480?

2. Find how many more yards there are in 100188 inches than in $3\frac{1}{2}$ furlongs.

3. The rent of a farm of 38 acres 1 rood 24 perches is £78. What is the rent per acre?

4. If a sovereign weighs 123 grains, how many can be coined out of a bar of gold weighing 1 lb. 11 oz. 1 dwt. 6 grs.?

5. In $4\frac{1}{2}$ seconds a train travels 110 yards. What is its rate in miles per hour?

6. A shopkeeper buys 125 yards of cloth at the rate of 2 yards for 5s., and 125 yards at the rate of 3 yards for 5s. What will he gain or lose by selling the whole at the rate of 5 yards for 10s.?

7. Find, by Practice, the cost of 12 tons 5 cwt. 3 qrs. 20 lb. at £2. 16s. 7d. per cwt.

8. Add together $\frac{1}{8}$, $2\frac{1}{13}$, $\frac{17}{39}$ and $1\frac{1}{3}$; and subtract $4\frac{5}{14}$ from $6\frac{2}{21}$.

9. Simplify $(\frac{1}{6}$ of $3\frac{1}{3}+\frac{2}{5}) \div (2\frac{1}{4}-\frac{3}{5}$ of $1\frac{5}{8})$.

10. (i) Express as decimals $\frac{3}{125}$ and $\frac{18}{1400}$.
(ii) Multiply 5·007 by 0·089.
(iii) Divide 7·3344 by 30·56.

40. **1.** From the product of 709 and three hundred and four thousand and sixteen subtract one hundred and eleven thousand two hundred and ninety-four. Express the result in words.

2. A man's income is £1575; if he spends each week £17. 18s. $7\frac{1}{2}$d., and each year gives away one-tenth of his whole income, how much does he save annually?

3. Express 15 miles 3 furlongs $2\frac{1}{2}$ yards in inches.

4. Eight bronze farthings weigh 1 oz. avoirdupois. What is the value in £ s. d. of 1 ton 4 cwt. $25\frac{1}{2}$ lb. of farthings?

5. If 3 cwt. 14 lb. of groceries cost 15s., what would 1 ton of similar goods cost at the same rate?

6. A gang of workmen dig a trench in 8 days of 9 hours each. How many days would they have taken if they had worked 12 hours a day?

7. Find, by Practice, the rental of 179 acres 3 roods 16 perches at £1. 3s. 4d. per acre.

8. Add together $3\frac{5}{7}$, $6\frac{1}{3}$, $2\frac{4}{15}$, and $6\frac{8}{28}$; and subtract $7\frac{11}{14}$ from $9\frac{2}{3\frac{1}{8}}$.

9. Simplify $(4\frac{5}{12} \div 21\frac{1}{8}) \div (14\frac{1}{2} \div 5\frac{8}{11})$.

10. (i) Express 0·0875 as a fraction in its lowest terms, and $\frac{4\frac{1}{2}}{3\frac{1}{2}}$ as a decimal.
(ii) Multiply 4·056 by 0·085.
(iii) Divide 1·921 by 45·2.

1. Multiply seven millions five thousand six hundred and eighty-three by four thousand and seven; and express the result in words.

2. Divide £2101. 15s. into 48 equal parts, by repeated short division.

3. Express 1111040 ounces in tons.

4. How many plots, each containing 3 roods 20 perches 20 square yards, are there in 41 acres 1 rood 11 perches $2\frac{1}{4}$ square yards?

5. If a clock uniformly loses $7\frac{1}{2}$ seconds in 12 hours, how many minutes and seconds will it lose in a complete week?

6. If 7 cwt. 2 qrs. 14 lb. of merchandise cost £11. 2s. $4\frac{3}{4}$d., how many cwt. can be bought for £4. 7s. 6d.?

7. What is the cost of 1069 articles at 6s. $6\frac{3}{4}$d. each?

8. Find the value of $2\frac{3}{7}+3\frac{1}{2}-3\frac{3}{4}+6\frac{1}{2}$; and multiply $3\frac{3}{14}$ by $2\frac{1}{10}$.

9. Divide the product of $4\frac{1}{4}$ and $3\frac{3}{8}$ by their difference.

10. (i) Express 0·024 as a vulgar fraction in its lowest terms, and $\frac{27}{160}$ as a decimal.
(ii) Add together 0·09, 1·245, 3·6 and 0·005; and subtract 3·094 from the result.
(iii) Divide 0·6996 by 0·055.

42. 1. Divide eight millions five hundred and twenty-seven thousand two hundred by four hundred and eight; and express the result in words.

2. Multiply £678. 14s. $4\frac{3}{4}$d. by 579.

3. How many seconds are there in the interval between quarter-past six on Monday morning and half-past seven on the following Saturday evening?

4. Find how often 3 cwt. 2 qrs. 27 lb. is contained in 18 tons 10 cwt. 1 qr. 13 lb.

5. If a horse gallops a distance of 1 mile $3\frac{3}{4}$ furlongs in $2\frac{3}{4}$ minutes, what average number of feet does he travel in one second?

6. If 32 perches of land cost £24, what will be the value of a piece of similar land containing 7 acres 3 roods 16 perches?

7. Find the cost of repairing 14 miles 3 furlongs 209 yards of railway at £100. 13s. 4d. per mile.

8. Add together $\frac{1}{8}$, $\frac{7}{8}$, $\frac{3}{8}$, $\frac{1}{8}$ and $\frac{5}{8}$; and subtract $3\frac{5}{8}$ from $8\frac{5}{32}$.

9. Divide $8\frac{7}{8}-7\frac{5}{7}$ by $12\frac{1}{4}\frac{3}{4}-11\frac{1}{7}$.

10. (i) Subtract 7·1007 from 11·1, and take the difference from 4·05.
(ii) Multiply 0·96875 by 1·28.
(iii) Divide 25·3 by 0·0275.

43. 1. Multiply one million two hundred and four thousand and seventy by six thousand and fifty; and express the result in words.

2. Find, by the shortest method, the 72nd part of £68877. 4s. 6d.

3. Express 654320 drams in tons, cwt., qrs., lb., oz.

4. Multiply 14 cwt. 3 qrs. 2 lb. 12 oz. by 5; and divide 27 days 7 hours 3 minutes 15 seconds by 7.

5. Divide the difference between $3\frac{1}{4}$ and $\frac{5}{14}$ by the sum of $2\frac{3}{5}$ and $\frac{3}{7}$.

6. Multiply 30·87 by 6·809; and divide 7·390152 by 2·408.

7. Add together $\frac{3}{5}$ of half-a-crown, $\frac{4}{7}$ of a guinea, and $\frac{2}{3}$ of $\frac{3}{4}$ of £1. 4s. 6d.

8. If a man can walk 5 miles in one and a half hours, how long will it take him to walk 1320 yards at the same rate?

9. Find the value of 3 lb. 7 oz. 7 dwt. 12 grs. at £2. 2s. per pound.

10. Find the simple interest on £1275. 4s. 4d. at 3 per cent. for 4 years 2 months.

44. 1. Divide nine hundred and seventy-three thousand and forty-seven into two parts, one of which is greater than the other by two hundred and seventy-nine thousand four hundred and twenty-five. Write the result in words.

2. Multiply £2579. 0s. $0\frac{3}{4}$d. by 147.

3. Express 758631 minutes in weeks, days, hours, minutes.

4. Multiply 17 yards 2 feet 11 inches by 12; and divide 116 acres 2 roods 35 perches by 9.

5. Divide the sum of $3\frac{2}{3}$ and $\frac{8}{11}$ by their difference, and multiply the result by the product of $1\frac{2}{5}$ and $\frac{4}{13}$.

6. Multiply 60000 by ·0083; and divide 90·1879 by ·503.

7. From $\frac{9}{73}$ of £72. 7s. 10d. subtract $\frac{1}{12}\frac{3}{2}$ of £1. 1s.

8. If a watch gains 50 minutes in a week, find, to the nearest second, how much it gains in an hour.

9. Find the cost of making a road 2 furlongs 24 poles 2 yards 1 foot long at £182. 17s. 6d. per furlong.

10. Find the simple interest on £985. 6s. 8d. for 5 years at $4\frac{1}{4}$ per cent. per annum.

45. 1. Multiply three millions fifty thousand six hundred and eighty by four thousand and seventy ; and express the result in words.

2. Find, by the shortest method, the 32nd part of £841482. 2s. 8d.

3. How many inches are there in 3 furlongs 29 poles 2 yards ?

4. Multiply 19 tons 2 cwt. 3 qrs. 24 lb. by 7 ; and divide 191 quarters 7 bushels 2 pecks 1 gallon by 12.

5. Multiply $5\frac{2}{11}$ by $2\frac{8}{19}$, and divide the result by $5\frac{1}{7}$.

6. Express in its simplest form $\frac{6{\cdot}1275 \times {\cdot}032}{{\cdot}00024}$.

7. Add together $3\frac{2}{3}$ of 10s. $0\frac{3}{4}$d., $1\frac{8}{9}$ of 14s. $0\frac{3}{4}$d., and $2\frac{8}{5}$ of 14s. $10\frac{3}{4}$d.

8. If 29 yards of silk cost £6. 0s. 10d., what will be the cost of 288 yards of the same quality ?

9. Find the cost of lighting a building for 5 hours 35 minutes each day for 40 days, at the rate of 3s. 9d. per hour.

10. Find the simple interest on £3304. 11s. 8d. for $4\frac{1}{4}$ years at 4 per cent. per annum.

46. 1. Divide twenty-seven millions three thousand and four by three hundred and twenty-nine; and express the result in words.

2. Multiply £435. 17s. $2\frac{1}{4}$d. by 31.

3. Express 138870 minutes in weeks, days, hours and minutes.

4. Multiply 3 bushels 2 pecks 1 gallon by 9; and divide 11 lb. 10 oz. 12 dwt. 5 grs. by 7.

5. Divide the sum of $3\frac{3}{4}$ and $4\frac{4}{5}$ by their difference.

6. Express ·109375 as a vulgar fraction in its lowest terms; and divide 7·603017 by ·843.

7. Find the value in yards, feet, inches of $\frac{3}{13}$ furlong $+ \frac{5}{9}$ pole $+ \frac{7}{24}$ yard $- \frac{5}{8}$ inch.

8. Find the cost of 7 cwt. 3 qrs. 22 lb. at £1. 12s. 8d. per cwt.

9. How many sovereigns can be made from a bar of gold of standard fineness weighing 60 lb. (troy), if 3 ounces are worth £11. 13s. 7d.?

10. What will £225 amount to in 4 years if invested at simple interest at $3\frac{1}{2}$ per cent.?

47. 1. Multiply two millions seven thousand eight hundred and sixteen by six thousand and eight; and express the result in words.

2. Divide £227193. 0s. $1\frac{1}{2}$d. by 353.

3. Express 74334 inches (linear) in yards, feet, and inches.

4. Multiply 3 tons 13 cwt. 2 qrs. 12 lb. by 8; and divide 76 square yards 2 square feet 106 square inches by 5.

5. Find the difference between $1\frac{2}{3}$ of $2\frac{7}{9}$ and $3\frac{1}{18}\frac{7}{8}$; find also the quotient of $\frac{5}{27}$ of $4\frac{1}{2} \div 1\frac{3}{7}$ of $5\frac{1}{5}$.

6. Find the value of $22{\cdot}5 \times {\cdot}0241 \times {\cdot}0024$; and divide 9·065 by 0·049.

7. Find the value of $\frac{1}{32}$ of 1 ton + $\frac{1}{160}$ of 5 cwt. + $3\frac{3}{5}$ of 11 cwt. 3 lb.

8. What will 4 yards 31 inches of cloth cost if 23 yards 1 foot cost £18?

9. Find the cost of 4 bushels 3 pecks 1 gallon 2 quarts at £3. 17s. 4d. per quarter.

10. Find the simple interest on £2705 for 6 years 8 months at 3 per cent. per annum.

48. 1. Divide forty-five millions three hundred thousand nine hundred by four hundred and ninety-two; and express the result in words.

2. Multiply £836. 13s. 10½d. by 480.

3. Express 32567 square inches in square yards, feet, and inches.

4. Multiply 1 ton 18 cwt. 3 qrs. 11 lb. by 8; and divide 23 quarters 5 bushels 3 pecks by 6.

5. Simplify $(\frac{3}{4}+\frac{6}{7}-\frac{5}{8}) \div (1\frac{5}{14}+\frac{2}{7}+1\frac{3}{16})$.

6 Multiply 350·4 by ·0105; and divide the product by ·0000219.

7. Find the value of $\frac{4}{17}$ of 1 ton 10 cwt. 40 lb. $-\frac{3}{8}$ of 3 qrs. 21 lb.

8. Find the cost of repairing 2 miles 7 furlongs 25 poles of road at £13. 9s. 4d. per mile.

9. When tea is 2s. 3d. per lb. a grocer buys 5 cwt. 3 qrs. How much at 1s. 9d. per lb. could be bought with the same money?

10. Find to what sum £1043. 15s. will amount in 2 years 1 month if placed at simple interest at $5\frac{3}{8}$ per cent. per annum.

49. 1. Multiply four millions fifty thousand three hundred and nine by nine thousand and thirty; and express the result in words.

2. Divide £6105. 9s. 9d. by 108, by repeated short division.

3. Reduce 5 quarters 5 bushels 3 pecks 1 gallon to pints.

4. Multiply 1 ton 7 cwt. 3 qrs. 7 lb. by 5; and divide 2 miles 7 furlongs 11 poles 5 yards by 9.

5. Simplify $(\frac{4}{5} - \frac{16}{25} + \frac{24}{125}) \div (\frac{2}{3} - \frac{2}{9} + \frac{52}{81})$.

6. Add together 9·968, 198·01, ·9863204 and 225; and multiply 9·09652 by ·008304.

7. Find the value of $6\frac{7}{10}$ days $- \frac{9}{14}$ week $- \frac{8}{5}$ hour $+ \frac{11}{18}$ minute.

8. Find the value of 1 cwt. 2 qrs. 18 lb. 5 oz. of merchandise at £10. 5s. 4d. per quarter.

9. If a man walks at the uniform rate of 7 miles 4 furlongs 26 poles 3 yards 2 feet in 1 hour 45 minutes, how many feet will he walk in $\frac{3}{4}$ hour?

10. Find the simple interest on £2500 for 6 years 3 months at £3. 10s. per cent.

50. 1. Divide sixty-five millions six hundred and forty-one thousand by eight hundred and twenty; and express the result in words.

2. Multiply £297. 18s. $7\frac{1}{4}$d. by 804.

3. Reduce 3 roods 8 perches 5 square yards 2 square feet to square feet.

4. Multiply 3 qrs. 15 lb. 7 oz. 5 drs. by 7; and divide 1 mile 4 furlongs 13 poles by 11.

5. Simplify $7\frac{1}{2} - (3\frac{2}{3} + \frac{4}{5}) - \frac{2}{5}$ of $1\frac{1}{6}$.

6. Find the sum of ·00125, 2·023, 21, 23·84 and ·292; and divide 884·576 by 320.

7. Subtract $\frac{3}{8}$ of a rood from $\frac{3}{11}$ of an acre, giving the result in square yards.

8. What is the cost of 3 tons 5 cwt. 2 qrs. 21 lb. at £2. 14s. 8d. per cwt.?

9. If the carriage of $15\frac{1}{2}$ cwt. for 60 miles cost 7s. 9d., how many miles ought $3\frac{1}{4}$ cwt. to be carried for the same money?

10. What is the simple interest on £440 for 7 months at $3\frac{3}{4}$ per cent. per annum?

1. Multiply five millions two hundred and seven thousand six hundred and ninety-eight by seven thousand and nine: and express the result in words.

2. Divide £5172. 12s. $5\frac{3}{4}$d. by 121, by repeated short division.

3. Reduce 1 lb. 3 oz. 17 dwt. 5 grs. to grains.

4. Multiply 32 miles 7 furlongs 5 poles 5 yards by 9; and divide 37 tons 5 cwt. 3 qrs. 5 lb. by 9.

5. Divide $2\frac{1}{4} - \frac{2}{3}$ of $1\frac{1}{6}$ by $\frac{1}{8}$ of $3\frac{1}{3} + \frac{7}{8}$.

6. Multiply 17·0875 by 0·0683; and divide 0·264404 by 26·6.

7. Find the value of $\frac{3}{4}$ of £5. 7s. 11d. + $1\frac{1}{3}$ of £20. 5s. $9\frac{3}{4}$d. − $1\frac{7}{9}$ of £11. 12s. 6d.

8. Find the cost of 2 quarters 3 bushels 1 peck 1 gallon of oats at 18s. 8d. per quarter.

9. If 1 ton 12 cwt. 3 qrs. of coal cost £1. 12s. 9d., what is the value of 2 qrs. 14 lb.?

10. Find the simple interest on £750 for 5 years 4 months at $2\frac{1}{2}$ per cent. per annum.

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52. 1. Divide fifty-four millions nine hundred and sixty-nine thousand nine hundred and twenty by six hundred and seven ; and express the result in words.

2. Multiply £946. 17s. 8½d. by 321.

3. Reduce 69 days 10 hours 39 seconds to seconds.

4. Multiply 2 quarters 3 bushels 3 pecks 1 gallon by 9 ; and divide 7 tons 3 qrs. 11 lb. by 50.

5. Simplify $(\frac{3}{5}+\frac{2}{3\frac{1}{9}}-\frac{7}{11\frac{1}{7}})(\frac{3}{7}+\frac{5}{8}-\frac{3}{7\frac{7}{7}})$.

6. Multiply 5·7608 by 0·0605 ; and divide 0·109476 by 9·7312.

7. Add together $\frac{3}{7}$ of £7. 5s. 3d., $\frac{4}{13}$ of £17. 15s. 10½d., and $\frac{5}{17}$ of £1. 6s. 11d.

8. Find the cost of 2 tons 5 cwt. 2 qrs. 16 lb. at £28. 5s. 10d. per ton.

9. If 5 quarters 3 bushels of wheat cost £10. 7s. 10d., what will 1 bushel 2 pecks cost ?

10. Find the simple interest on £1275 for 5 years at £3. 16s. per cent. per annum.

1. Multiply six millions thirty-nine thousand and seven by six thousand and fifty; and express the result in words.

2. Divide £6218. 11s. $0\frac{1}{2}$d. by 110, using the shortest method.

3. Express 5151 feet (linear) in furlongs, poles, and yards.

4. Multiply 2 cwt. 2 qrs. 17 lb. 3 oz. by 7; and divide 8 lb. 5 oz. 19 dwt. 12 grs. by 6.

5. Simplify $(3\frac{1}{3}$ of $\frac{1}{7}+\frac{2}{21}$ of $2-\frac{5}{8}$ of $\frac{4}{21})\times 1\frac{3}{4}$.

6. Multiply 0·009655 by 1·708; and divide 8·775 by 2340.

7. Find the number of square feet in $\frac{5}{8}$ of $3\frac{5}{11}$ of an acre.

8. Find the cost of 4 tons 17 cwt. 1 qr. at £2. 13s. 4d. per ton.

9. If 20 yds. 1 ft. of netting cost £2. 5s. 9d., how many yards can be bought for £1. 13s. 9d.

10. Find the interest on £511 lent from January 1st to April 11th, 1902, at $4\frac{3}{4}$ per cent. per annum.

54. 1. Divide twenty-three millions eight hundred and twenty-four thousand five hundred by three hundred and fifty; and express the result in words.

2. Multiply £137. 16s. $9\frac{3}{4}$d. by 912.

3. Reduce 1 acre 1 rood 2 perches to square yards.

4. Multiply 2 cwt. 2 qrs. 11 lb. by 9; and divide 23 qrs. 5 bush. 3 pks. by 6.

5. Simplify $(2\frac{1}{8} \div 3\frac{1}{5}) \times 2\frac{1}{4} - \frac{1}{8}$ of $4\frac{1}{8} - 3\frac{47}{120}$.

6. Multiply 0·039 by 3·473; and divide 0·12936 by 23·1.

7. Add together $\frac{5}{18}$ of a guinea, $\frac{3}{32}$ of a sovereign, $\frac{7}{10}$ of a crown, and $\frac{5}{16}$ of a shilling.

8. Find the cost of 7 cwt. 2 qrs. 14 lb. at 29s. 2d. per cwt.

9. If 70470 dozen of wine are produced by a vineyard, yielding 540 gallons per acre, and two gallons of wine go to the dozen, find the area of the vineyard in acres.

10. Find the simple interest on £875 from March 10th, 1902, to May 22nd, 1903, at 5 per cent. per annum.

5. 1. What will be the cost of carriage of $\frac{3}{16}$ of a cwt carried 50 miles at a farthing a pound per mile?

2. Find the least common multiple of 1125, 2200 and 2525.

3. Find the value of $(1\frac{3}{4}+\frac{2}{3}$ of $\frac{7}{8}) \div (1\frac{3}{4}$ of $1\frac{1}{2}-\frac{7}{8})$.

4. A bar of gold weighing 8 oz. 8 dwt. is worth £3. 16s. 8d. per ounce, and a bar of silver weighing 210 oz. is worth 2s. 10d. per ounce; how much more valuable is the gold than the silver?

5. Reduce $\frac{2}{63}$ of $\frac{9}{65}$ of £81. 13s. 4d. $+\frac{3}{41}$ of $\frac{82}{95}$ of 8s. $10\frac{1}{4}$d. $-\frac{5}{17}$ of 9s. 11d. to the fraction of £6. 10s.

6. Express in cwt., qrs., and lb. the value of ·034375 of 2 tons.

7. A man walks 6 kilometres an hour, taking two steps a second. Find the length of his stride in centimetres, to the nearest integer.

8. What is the simple interest on £215. 2s. 6d. for 3 years 73 days at £4. 10s. per cent. per annum?

9. A garrison has provisions for 750 men for 20 days, allowing 1 lb. each per day. How many days can 800 men be maintained on the same supply, if the daily ration is reduced to 12 ounces?

10. A man left to his eldest son half his property, to each of his other two sons $\frac{5}{12}$ of the remainder, and the rest, amounting to £1000, in smaller legacies. What was the value of his whole property?

56. 1. How many sovereigns are coined out of 20 lb. weight (troy) of standard gold, which is worth £3. 17s. $10\frac{1}{2}$d. per ounce?

2. Multiply £28. 15s. 9d. by $11\frac{3}{4}$; and divide £53. 8s. 9d. by $256\frac{1}{2}$.

3. By what must $3\frac{1}{7}$ of $1\frac{2}{3}+1\frac{3}{8}$ be divided in order to produce a quotient equal to $3\frac{1}{7}-2\frac{3}{4}$ of $\frac{5}{8}$.

4. A bale of cotton weighs 3 cwt. 2 qrs. 15 lb.; 25 such bales were bought at $9\frac{1}{2}$d. per lb., and sold at 1s. $0\frac{1}{2}$d. per lb. Find the profit on the transaction.

5. Reduce 2 cwt. 2 qrs. to the fraction of half a ton, and $7\frac{1}{2}$d. to the decimal of £3. 2s. 6d.

6. A bankrupt's debts exceed his property, which is worth £1736, by the sum of £504. How much can he pay in the £?

7. How many steps, each 65 centimetres long, does a French soldier take in marching 273 kilometres?

8. A builder estimated that 12 men would complete a house in 45 days, working 10 hours a day. Three of them, however, are unable to work, and the rest are obliged to work 2 hours a day less time; in how many days will the house be finished?

9. If twenty lengths of a rod which is supposed to be a yard are found to measure 19 yds. 1 ft. 9 in., what is the true length of the rod?

10. An orchard 220 yds. long and 110 yds. wide is planted with trees; if each tree occupies a space 12 ft. long and 5 ft. wide, and the cost £1. 10s. per dozen, what will be the total expense?

7. 1. How many wooden blocks, $9\frac{1}{2}$ in. by $4\frac{1}{4}$ in., would be required to pave a floor 25 ft. 4 in. long and 19 ft. $1\frac{1}{2}$ in. wide?

2. Multiply £124. 16s. 8d. by 1·25; and divide £1. 16s. 5d. by $5\frac{3}{4}$.

3. Divide the sum of the least and greatest of $\frac{3}{4}$ of $\frac{7}{8}$, $\frac{25}{36}$, $\frac{7}{24}$ of $2\frac{1}{3}$, $\frac{15}{48}$ by the difference between the other two.

4. Reduce 86 gallons 2 quarts 1 pint to the fraction of 122 gallons 1 quart 1 pint.

5. Find the value of 1·75 of £1. 10s. + $\frac{2}{3}$ of $\frac{4}{5}$ of $1\frac{1}{2}$ of £2. 10s. + 1·25 of £11; and express the result as the decimal of £10.

6. Into how many farms, each containing 24 hectares 2 ares 9 centiares, can an estate of 1825 hectares 58 ares 84 centiares be divided?

7. A man buys 438450 bricks at £3. 6s. 8d. per thousand, and sells two-thirds of them at 8s. 4d. per hundred, and the rest at 9s. per gross of 144. Find what he gains on the transaction.

8. A cistern 5 feet square contains water 11·09 in. deep. How many gallons of water does it contain? (1 gallon = $277\frac{1}{4}$ cubic inches.)

9. The rent of 14 houses for five weeks amounts to £36. 15s. What would be the total rent of 35 houses of the same kind for a year (52 weeks)?

10. A can do a piece of work in 20 days, B in 24 days, and C in 30 days. How much longer will it take B and C together than A and C together to do the work?

58. 1. Prove that the product of 725 and 987, increased by 49, is a multiple of 983.

2. Find the value of $2\frac{1}{4}$ of $\frac{7}{8} + 3\frac{1}{2} - 1\frac{5}{7}$ of $5\frac{5}{8} \div 4\frac{1}{8}$.

3. What part of $4\frac{3}{8}$ of £8. 4s. $9\frac{1}{2}$d. is $1\frac{5}{16}$ of £7. 1s. 3d.?

4. Find the value in money of 2·875 of £5. 12s. 6d.; and reduce 17 cwt. 3 qrs. 7 lb. to the decimal of three-quarters of a ton.

5. A partner in a business is entitled to $\frac{4}{9}$ of the profits. What were the average annual profits when his share for $2\frac{1}{3}$ years was £1010. 17s. 9d.?

6. What will it cost to carpet a room 20 ft. 6 in. long and 12 ft. wide, the carpet being $\frac{3}{4}$ yard wide and costing 2s. 3d. per yard?

7. Find, to five places of decimals, the number of kilograms in the weight of 15 gallons of water. (1 gallon = 10 lb.; 1 kilogram = 2·205 lb.)

8. Find the simple interest on £863. 15s. for 2 years 9 months at $3\frac{1}{2}$ per cent. per annum.

9. If 3 tons are carried 54 miles for £2. 0s. 6d., how far can 11 tons be carried for £5. 10s.?

10. Out of a bag of marbles one-third were given to A, and a quarter of what remained to B; C then took 90, and the remainder, which was equal to one-fourth of the whole, were given to D. How many marbles were in the bag originally?

59. 1. A truck-load of coal weighing 8 tons 17 cwt. 3 qrs. 21 lb. is sold for £8. 17s. 11¼d. Find the price per ton.

2. The contents of a bag are worth £66. 15s. 11d., and it contains an equal number of sovereigns and pence, three times as many half-crowns as sovereigns, and as many shillings as the rest of the coins together. How many coins are there of each kind?

3. Simplify $1\frac{1}{2}$ of $(2\frac{2}{3}+3\frac{3}{4}\div 4\frac{4}{5}+5\frac{5}{6})$.

4. Reduce $\frac{8}{9}\frac{9}{5}$ of $\frac{1}{6}\frac{9}{5}$ of £2. 12s. 1d. + $\frac{4}{4}\frac{8}{7}$ of $\frac{9}{1}\frac{4}{1}\frac{4}{5}$ of £5. 13s. 9d. to the fraction of £11. 6s. 11d.

5. Express in yards and the fraction of a yard the value of ·0109375 of a mile.

6. What will it cost to carpet a room 21 feet long and 18 feet wide, the carpet being 27 inches wide and costing 3s. 9d. per yard?

7. Find, to the nearest farthing, the price per lb. in English money of coffee which costs in France 4·50 francs per kilogram. (£1 = 25·25 francs; 1 kilogram = $2\frac{1}{8}$ lb.)

8. Express in its simplest form—

$$(7\cdot35\times\cdot0143\div7\cdot5075)-(\cdot152\times\cdot033\div1\cdot045).$$

9. A railway company charges each of a number of excursionists two fifths of the ordinary fare, which is at the rate of 6s. 3d. for 50 miles. How much should 250 excursionists pay to travel 120 miles?

10. A takes $\frac{1}{5}$ of a cake, B $\frac{1}{4}$ of the remainder, and C $\frac{1}{2}$ of what B leaves. Find what decimal fraction of the whole cake remains after C has had his share.

60. 1. The area of the county of Dorset is 624341 acres, and the population in 1901 was 199994. Find, to the nearest integer, the number of persons per square mile.

2. Add together the sum, the difference, the product, and the two quotients of ·04 and ·005.

3. Simplify $2\frac{1}{8}$ of $\frac{7}{11}-\frac{7}{8}+2\frac{5}{12}\div(6\frac{1}{20}\frac{8}{0}-3\frac{17}{30})$.

4. Divide 7s. $1\frac{1}{2}$d. by $1\frac{9}{15}$, and subtract from the quotient $\frac{29}{30}$ of 17s. 6d.

5. Reduce 1 furlong 1 yard 1 foot $1\frac{1}{2}$ inches to the decimal of 1 mile.

6. A house contains 15 windows, each window containing 16 panes, each of which measures 21 inches by 16 inches. What will be the expense of glazing the whole at $10\frac{1}{2}$d. per square foot?

7. Find, to the nearest farthing, the price per lb. in English money of tea which costs in France 7·50 francs per kilogram. (£1 = 25·25 francs; 1 kilogram = 2·2 lb.)

8. Find, to the nearest penny, the simple interest on £249. 19s. $9\frac{3}{4}$d. for 10 years at 4 per cent.

9. Divide £2645 between A, B and C, so that A's share may be $\frac{2}{3}$ of B's share, and B's share four times as great as C's share.

10. A man pays 1d. each time that he crosses a bridge on foot, and 6d. each time that he drives over. He crossed 365 times and paid £2. 17s. 11d.; how many times did he walk and how often did he drive?

81. 1. The cost price of certain goods is £2. 12s. 6d. per ton, and the selling price is £2. 18s. 9d. per ton. How many tons must be sold to gain £9. 5s. $11\frac{1}{4}$d.?

2. If $\frac{4}{10}$ of $\frac{5}{7}$ of 12s. 3d. is taken from $\frac{7}{18}$ of $2\frac{1}{2}$ guineas, what fraction of 25s. will remain?

3. Add $\frac{3}{7}$ of $4\frac{2}{3}$ to $14\frac{3}{8}$ of $5\frac{1}{21}$, and add the result to $(\frac{5}{6}$ of $3\frac{1}{7}) \div (2\frac{5}{8} - 1\frac{1}{3})$.

4. Find, in its lowest terms, a vulgar fraction equal in value to 0·021875.

5. Express in furlongs, poles, yards, and the decimal of a yard the value of 0·5645 of a mile.

6. A barrel containing 40 litres of liquid weighs 40 kilograms 5 hectograms; empty, it weighs 3 kilograms 9 hectograms. Give in grams the weight of a litre of the liquid.

7. If $46\frac{1}{2}$ yards of ribbon cost £6. 15s. $7\frac{1}{2}$d., how many yards of the same ribbon can be bought for £2. 18s. 4d.?

8. Find the simple interest on £850. 12s. 6d. from 12th March 1902 to 29th December 1903 at 4 per cent. per annum.

9. The wine contained in a cask will just fill three dozen small bottles. How many bottles of three times the capacity will be required for four times the quantity of wine?

10. A shopkeeper bought 96 articles at £1. 0s. $2\frac{1}{2}$d. each, and sold the lot at a gain of $12\frac{1}{2}$ per cent. How much did he receive, and how much did he gain?

62. 1. A train contains 237 third-class passengers travelling on an average $5\frac{1}{2}$ miles each, 71 second-class passengers travelling on an average 6 miles each, and 17 first-class passengers travelling on an average 8 miles each. The rate of third-class being 1d. per mile, second-class $1\frac{1}{2}$d. per mile, and first-class 2d. per mile, find the total amount paid.

2. Divide $8\frac{7}{8}-7\frac{4}{7}$ by $12\frac{13}{14}-11\frac{4}{7}$, and add the result to $\frac{5}{6}+\frac{9}{14}+\frac{35}{24}$.

3. Express £3. 12s. $3\frac{3}{4}$d. as the decimal of £4; and reduce £3. 10s. $1\frac{1}{2}$d. to the fraction of £3. 18s. $4\frac{1}{2}$d.

4. Express in cwt., lb., and the decimal of a lb. the value of 0·53 of 5 cwt. 3 qrs. 7 lb.

5. What is the continued product of 102·5, 1·025, and ·010225; and the quotient of 4·8 divided by ·00016.

6. If a metre is 39·37 inches, how many minutes will a man, walking at the rate of 6 kilometres an hour, take to walk a mile?

7. What is the cost of a door 7 ft. 6 in. high and 3 ft. 6 in. wide at 4s. 6d. per square foot?

8. After $\frac{1}{6}$ of a man's rent had been deducted the landlord paid income-tax on the remainder at 1s. 3d. in the £, and the tax amounted to £3. 12s. 11d.; what was the rent?

9. If a man travels 84 miles in 4 days by walking 7 hours a day, how many miles can he travel in twelve days walking 10 hours a day?

10. If a grocer paid £10. 6s. 3d. for $5\frac{1}{2}$ cwt. of currants, how must he sell them per lb. to gain 12 per cent. on his outlay?

3. 1. A stone of flour makes 16 lb. of bread. How many 2-lb. loaves can be made out of a ton of flour?

2. How many times is the G.C.M. of 48, 36, 72, 24 contained in their L.C.M.? And reduce $\frac{23}{25}\frac{36}{80}\frac{12}{00}$ to its lowest terms.

3. Express as a fraction in its lowest terms the ratio of 26 lb. 12 oz. to 2 qrs. 17 lb. 9 oz.

4. Express in quarters, bushels, pecks, and the decimal of a peck the value of 2·45 of 11 quarters.

5. Find the difference between $13\frac{2}{3}$ divided by $16\frac{2}{3}$ and $\frac{4}{7}$ of $\frac{3}{11}$ of $3\frac{1}{2}$ divided by $\frac{8}{9}$ of $\frac{3}{22}$ of 12.

6. Find the cost of making 50 miles 6 furlongs 25 poles of railway at £820. 17s. 4d. per mile.

7. If 23 articles cost £25. 19s. 5d., how many articles of a similar quality can be purchased for £41. 15s. 7d.?

8. Express 387 acres 3 roods 35 perches in hectares, correct to three decimal places, assuming that 1 acre is equivalent to ·404671 hectares.

9. The carriage for goods on a railway being at the rate of 25s. per ton for 120 miles, what should be the charge for 168 lb. carried 288 miles?

10. A grocer buys $5\frac{3}{4}$ cwt. of tea for £80. 10s., but 23 lb. get spoiled and are unsaleable. At what price per lb. should he sell the remainder so as to gain 35 per cent. on his outlay?

34. 1. A goods train consists of 12 trucks carrying $7\frac{1}{2}$ tons each, 10 carrying 8 tons 15 cwt. 3 qrs. each, and 7 trucks carrying 9 tons 12 cwt. 3 qrs. each. If the weight of the trucks themselves amounts to 135 tons 13 cwt. 1 qr., what is the total weight drawn by the engine?

2. Multiply the difference between $3\frac{1}{2}$ of $1\frac{1}{14}+7\frac{1}{2}$ and $2\frac{1}{7}\div\frac{2}{3}$ of $\frac{5}{21}$ by the sum of $\frac{1}{4\frac{3}{4}}$ and $\frac{1}{5\frac{1}{7}}$.

3. Express in weeks, days, hours, and the decimal of an hour the value of 0·675 of 3 weeks 4 days 10 hours.

4. How many acres, roods, perches and yards are there in ten thousand square yards?

5. A debtor owes £4146. 12s. 6d., and the value of his estate is such that he can pay 11s. 8d. in the £. What is the estate worth?

6. If 1 kilometre equals $1093\frac{2}{3}$ yards, how many miles are there in 5280 kilometres?

7. If the tax upon property assessed at £123. 10s. amounts to £9. 5s. 3d., how much should be paid upon property assessed at £102. 18s. 4d.?

8. A, B and C can mow a field in 5 days; A and B can mow the same field in 7 days. How long would it take C to mow a field twice the size?

9. If 12 cwt. can be carried $11\frac{1}{4}$ miles for 12s., what weight can be carried 90 miles for £2. 6s.?

10. If a grocer, by selling tea at 2s. 6d. per lb., gains 12 per cent. on his outlay, what did it cost him per cwt.?

5. **1.** A boat's crew, whose weights are 10 st. $7\frac{1}{2}$ lb., 11 st. $10\frac{1}{2}$ lb., 13 st. 1 lb., and 10 st. 10 lb., race another crew of four men whose weights are all equal. If the first crew are together half-a-stone lighter than the second crew, what is the weight of each member of the latter?

2. Simplify $[(4\frac{3}{14}-2\frac{1}{4})\div(6\frac{1}{2}+2\frac{1}{7})]\div[(\frac{4}{7}+\frac{1}{2})\div(\frac{5}{7}-\frac{1}{2})]$.

3. Express £91. 12s. 8d. as a fraction, in its lowest terms, of £151. 15s. $4\frac{1}{4}$d.

4. Find the value in pounds, shillings, pence, and the decimal of a penny the value of 0·3125 of £4. 10s.

5. Reduce 3 bushels 3 pecks to the decimal of 1 quarter; and 12 feet $4\frac{1}{3}$ inches to the decimal of 1 mile.

6. If a man walks at the rate of 2·6822 metres in a second, how many miles will he travel in an hour, assuming a mile to be equivalent to 1·60932 kilometres.

7. A shopkeeper sold 54 yards of cloth for £28. 16s., thereby gaining the cost price of 10 yards. Find the cost price per yard.

8. If in a year of 365 days the interest on £375 amounts to £16. 17s. 6d., what would be the interest on a loan of £500 from March 9th to August 2nd, at the same rate per cent. per annum?

9. A wall was built by a certain number of men in 6 days. How long would twice as many men take to build a similar wall of the same height but four times as long and only two-thirds of the thickness?

10. A man buys two articles for £8 and £36 respectively, and sells them again, losing 40 per cent. on the first and gaining 15 per cent. on the second. How much does he gain or lose altogether?

66. **1.** A dealer buys 117 sheep for £248. 12s. 6d. Four died and 24 others have to be sold for 10s. apiece less than he gave for them; at what price must he sell each of the remainder to gain £24 on his original outlay?

2. Simplify $(3\frac{7}{8}-4\frac{1}{3}+2\frac{1}{1\frac{1}{2}})\div(9\frac{1}{3\frac{1}{6}}-7\frac{1}{2\frac{2}{7}})$.

3. Find what decimal of $2\frac{1}{2}$ lb. (troy) is 5 oz. 12 dwt. 12 grains.

4. Find the value of 2·109375 of £2. 4s.; and ·0016 of 7 days 5 hours 36 minutes 40 seconds.

5. Express as the fraction of a ton $\frac{8}{10}$ of a cwt. + $\frac{9}{20}$ of 15 cwt. 3 qrs. − 3 cwt. 2 qrs. 14 lb.

6. Find the value—in (i) French money, (ii) English money—of 1047 kilograms 5 decagrams of goods at 8 francs 5 centimes per kilogram. (£1 = 25·25 francs.)

7. If 3 men or 5 women do a piece of work in 11 days, in how many days will 5 men and 3 women do it?

8. A bankrupt whose debts amount to £4200. 6s. 8d., after dividing his property among his creditors, leaves £2625. 4s. 2d. unpaid; how much did he pay in the £?

9. If 70 chests of tea, each weighing 240 lb., cost £210; what will be the cost of 40 chests, each weighing 260 lb., supposing 16 lb. of the former to be worth 24 lb. of the latter?

10. A woman buys mackerel at 6s. 3d. per score. At what price per dozen must she sell so as to gain 40 per cent. on her outlay?

1. If a speculator purchased a million articles at £1. 15s. 2d. per score, and sold them at £1. 1s. $1\frac{1}{4}$d. per dozen, what amount of money would he gain or lose?

2. Simplify $10\frac{1}{2} \times 3\frac{8}{11} - 3\frac{1}{3} \div 4\frac{4}{9}$; and from the sum of 5·873, ·00215, 15 and 27·1 subtract 27·3457612.

3. The poor-rate being 1s. 8d. in the £, what is the rateable value of a property which pays annually a rate amounting to £208. 6s. 8d.?

4. What fraction of the area of the floor of a room 30 feet square would be left uncovered by 133 yards of carpet $\frac{3}{4}$ of a yard wide?

5. If £1 is equivalent to 4·85 dollars or 25·2 francs, find to the nearest penny the value of the contents of a drawer which contains 97 francs and 63 dollars.

6. How long would a column of men, extending 3420 feet in length, take to march through a street a mile long at the rate of 58 paces a minute, each pace being $2\frac{1}{2}$ feet?

7. Find the value of ·856 of 2 cwt. 26 lb. $+ 3\frac{5}{12}$ of 2 qrs. 10 lb.; and express 32 poles $2\frac{3}{4}$ yards as a decimal of 2 furlongs.

8. A wire 1509·85 feet in length is cut into strips each 45·6 feet long. Assuming that there is no loss of material in the cutting, how many strips can be cut off, and what is the length of the remainder in inches?

9. By selling goods for £66. 4s. 5d. there was a loss at the rate of 8 per cent. What was the cost price of the goods?

10. If 10 eggs are bought at one shop for 11d. and 8 eggs at another shop for 9d., and the lot sold at the rate of 1s. per dozen, how much per cent. was lost on the total outlay?

68. **1.** Three lots of cotton are sold at $5\frac{3}{4}$d., $5\frac{5}{8}$d. and $5\frac{7}{8}$d. per lb. If the weights are 100, 160 and 216 lb. respectively, what is the average price per lb.?

2. Simplify $(\frac{3}{4}-\frac{1}{2})\div(1+\frac{3}{4}$ of $\frac{1}{2})$; and find the decimal which added to the sum of 0·2916, 0·625 and 0·361 will make the total equal to 10.

3. If a bankrupt's assets amounted to £769. 16s., and his creditors lost £1283, what did he pay in the £?

4. Express $\frac{2}{3}$ of a shilling as the fraction of £5; and $3\frac{1}{8}$ of £1. 0s. $9\frac{3}{4}$d. as the fraction of £1. 10s.

5. If a metre contains 39·37 inches and a kilometre contains 1000 metres, express in kilometres and the decimal of a kilometre a distance of 344 miles 39 chains. (A chain = 22 yards.)

6. A sum of £173. 5s. is to be divided among 5 men and some women. A woman's share is equal to $\frac{1}{3}$ of a man's share; how many women were there if each man received £24. 15s.?

7. Find the value of 0·72 lb. + 0·3775 cwt. + 0·04375 ton.

8. If an army of 5400 men, besieged in a town with sufficient food to give each man a ration of 20 ounces per day for 5 weeks, be reinforced by 600 men and have their rations reduced to 15 ounces per day, how long will the provisions last?

9. A plumber sold 96 cwt. of metal for £109. 2s. 6d., and gained $12\frac{1}{2}$ per cent. on his outlay. What did it cost him per cwt.?

10. A tea merchant blends 144 lb. of tea at 2s. $10\frac{1}{2}$d. per lb. with 180 lb. of tea at 2s. 6d. At what price per lb. must he sell the mixture to make $12\frac{1}{2}$ per cent. profit on his total outlay?

1. How many bags of coffee, each weighing 2 cwt. 91 lb., at 1s. 2d. per lb. should be given in exchange for 21 chests of tea, each weighing 75 lb., at 2s. 11d. per lb.?

2. Divide the product of $2\frac{5}{8}$ and $2\frac{2}{15}$ by the difference between $2\frac{5}{8}$ and $2\frac{1}{4}$; and express the product of 9·375 by 0·0028 as a decimal, and as a vulgar fraction in its lowest terms.

3. By what fraction of an inch should a mountain $4\frac{1}{2}$ miles high be represented on a globe 18 inches in diameter, assuming the diameter of the earth to be 7900 miles?

4. If a boy requires $\frac{2}{3}$ as much meat as a man, and $\frac{7}{8}$ of a sheep are enough for 10 men and 6 boys, find (i) for how many men and (ii) how many boys a whole sheep would serve.

5. If a cubic centimetre of water weighs a gram, find the weight in kilograms of a rainfall of 0·075 metres over 0·405 hectares of ground. (A hectare = 10000 sq. metres.)

6. A sum of £325 was placed in the bank on 10th January 1902; principal and interest were withdrawn on 5th June. What amount was withdrawn, supposing the bank paid interest at the rate of $3\frac{1}{2}$ per cent. per annum?

7. Reduce 2 miles 5 furlongs to the decimal of 7 miles; and express 13s. 9d. as a fraction of £1. 8s. 5d.

8. A man some time ago paid £4. 4s. for 3 tons of coal; since then the price per ton has increased, so that now he would have to pay as much for 3 tons as would formerly have been charged for 5 tons If he has still 2 tons remaining in his cellar, what is their value at the new price?

9. If 5 per cent. is lost by selling a horse for £76, at what price must it be sold in order to gain 5 per cent.?

10. A grocer buys two qualities of tea, which cost him 2s. and 3s. per lb. respectively, and mixes them in proportion of 2 lb. of the former to 3 lb. of the latter, and sells the mixture at 3s. 6d. per lb. If the price of the cheaper tea rises to 2s. 6d. per lb., and he continues to sell at the same rate, by how much per cent. will his profit decrease?

70. 1. A fruiterer bought 7 boxes of oranges, each containing 360, for £5 and $\frac{1}{8}$ of them were bad. He sold the rest and gained £1. 2s. 6d.; what was the selling price per dozen?

2. Simplify $\left(\frac{2\frac{3}{4}}{5\frac{1}{2}} \div \frac{3\frac{1}{2}}{2\frac{1}{4}}\right) \times 1\frac{1}{8}$ of $\frac{1}{2}$; and divide the product of ·002899 and ·0437 by 4·237.

3. Find the dividend on £6420. 10s. at 17s. 3d. in the £.

4. If $3\frac{1}{5}$ lb. of tea cost as much as $42\frac{2}{3}$ lb. of sugar, and 8 lb. of sugar cost 1s. 6d., what is the price of 1 lb. of tea?

5. What will be the cost—in (i) French money, (ii) English money—of 40 kilograms 125 grams of tea at 8 francs 40 centimes per kilogram? (£1 = 25·25 francs.)

6. A house has 6 windows 10 ft. high by 3 ft. 2 in. wide, 7 windows 6 ft. high by 3 ft. wide, and 4 windows 4 ft. high by 2 ft. 6 in. wide; what will the glazing cost at 3d. per square foot?

7. Express as the decimal of 13s. 4d. the sum of $\frac{1}{4}$ of 16s. 11d., and ·065 of 16s. 8d.

8. The product of 2·5 and the sum of two quantities is divided by 0·978, and gives 1022·85 as quotient and 0·00645 as remainder. One of the two quantities is 59·0075; what is the other?

9. A fruiterer sells oranges at a penny apiece, and so doing makes a profit of 44 per cent. At what price per dozen would he have to sell them to lose 16 per cent.?

10. A grocer buys 3 cwt. of tea for £40. If he sells one-fourth of it at 2s. 4d. per lb., at what price per lb. must he sell the rest to make a profit of $8\frac{1}{2}$ per cent. on his original outlay?

1. 1. A man's weekly wages are £1. 3s. 9d. He is fined 9d. when he is late, and at the end of 20 weeks he has received £21. 15s. 3d.; how often was he late?

2. Simplify $5\frac{2}{3}-3\frac{3}{4}$ of $(1\frac{3}{7}-\frac{5}{11})$ of $1\frac{3}{5}+\frac{3}{5}$; and divide ·000015 by the continued product of ·002, ·0005 and ·03.

3. Two bales of goods, weighing respectively 1 ton 245 lb. and 13 cwt. 107 lb. respectively, were conveyed by train from London to Portsmouth. The carriage of the latter was 19s. $2\frac{1}{2}$d. less than that of the former; find the cost of carriage per cwt.

4. Find what fractional part 3 miles 1 fur. 112 yds. is of 21 miles 4 fur. 41 yds.; and reduce £157. 19s. $7\frac{1}{2}$d. to the decimal of £10000.

5. Find the cost—(i) in French money, (ii) in English money—of 9 kilometres 625 metres of silk at 4 francs 75 centimes per metre. (£1 = 25·25 francs.)

6. If a number of men in a certain time earn £255. 15s., how much will three times that number of men with double wages earn in one-fifth of the time?

7. An ordinary train leaves Paddington at 10 a.m. and travels at the rate of 30 miles an hour; an express leaves Paddington at 11·15 a.m., and travels on the same line at the rate of 45 miles an hour. At what distance from Paddington will the second train overtake the first?

8. You have 240 apples, and are told to divide some of them amongst three boys in the ratio of 8 : 9 : 10, and to keep the rest yourself. Assuming that you will be satisfied with the smallest number you can have under the circumstances, how many will each boy get?

9. If by selling sugar at 24s. per cwt. a grocer would lose 4 per cent., at what price per lb. must he sell it to gain 12 per cent.?

10. A tradesman charges his customers 10 per cent. above cost price, but allows a customer 5 per cent. on his account for cash. What is his gain per cent. on a cash transaction?

72. 1. A truck of coals containing 8 tons is sold at the pit's mouth for 13s. per ton, and delivered at a railway station distant 120 miles for £7. 14s. What is the cost of carriage per ton per mile?

2. Simplify $4\frac{3}{5} - 3\frac{3}{17}$ of $1\frac{25}{162} + (\frac{1}{3} \div \frac{5}{18})$; and express $\frac{0{\cdot}00436 \times 0{\cdot}987}{6{\cdot}54}$ in its simplest form.

3. Find what decimal of half-a-sovereign each of the silver coins now in circulation is, and add those decimals together.

4. What is the value of 7 tons 15 cwt. 1 qr. 27 lb. of copper at £58. 6s. 8d. per ton?

5. If 14 metres of material cost £2. 10s., what should be paid—in (i) English money, (ii) French money—for 1 metre 96 centimetres of the same material. (£1 = 25·25 francs.)

6. If 7 men mow 37 acres in 3 days, working 8 hours a day, how many men could mow a field twice the size in 7 days, working 4 hours longer each day?

7. Find the value of—

$$\frac{2}{3} \text{ of } \frac{1}{7\frac{1}{3}} \text{ of £1. 13s.} + \frac{1}{8} \text{ of } \cdot 125 \text{ of £4. 10s.}$$

8. A man 30 years of age has accumulated £3000 and has a salary of £600 a year, of which he spends £300 and saves £300. He resolves to stop work and give up his salary as soon as his savings would allow him to continue spending £300 until the age of 90; how long must he continue to work? (*N.B.*—No interest on savings is to be reckoned.)

9. A merchant refuses an offer of £132 for certain goods, but accepts an amount which will bring him a profit of 5 per cent. Had he accepted the former he would have lost 12 per cent.; what is the amount which he accepts?

10. A pair of scales is improperly balanced, so that 1 lb. in the one scale balances 15·75 oz. in the other; if a shopkeeper in selling goods places them in the latter scale, how much per cent. does he gain by such a proceeding?

3. 1. Reduce to its simplest form—

$$2\tfrac{1}{22} - \left\{ \frac{2\tfrac{1}{4}\tfrac{3}{5}}{6\tfrac{5}{7} - 4\tfrac{3}{5}} + 1\tfrac{4}{35} \right\} \div 3\tfrac{8}{10}.$$

2. Express the difference between $\frac{7}{8}$ of 11 cwt. 5 lb.; and ·21875 of 20 lb. as the decimal of a ton.

3. Find, to the nearest penny, the cost of 42 cwt. 3 qrs. 18 lb. of coal at 16s. 8d. per ton.

4. A man's assets are £18. 16s. 3d. and his debts are £376. 5s. What percentage of his debts can he pay?

5. The average weight of five metal bars is 2 kilograms 75 grams, and the weights of four of them are 3 kilograms 8 grams, 2 kilograms 92 grams, 2 kilograms 14 grams, and 1 kilogram 93 grams respectively. Find the weight of the fifth bar.

6. If a hare starts 15 yards before a greyhound, and takes 7 leaps of 6 feet each in 2 seconds, whilst the hound takes 9 leaps of $9\frac{1}{2}$ feet each in 4 seconds, in what time will the hound catch the hare?

7. A, B and C enter into partnership. A invests £2400, and B £3600; the total profit is £1440, of which A's share is £480. How much capital did C invest, and what is his share of the profit?

8. The water in a tank 5 ft. 4 in. long and 4 ft. 3 in. wide is frozen to a uniform depth of 9 inches. How many cubic feet of ice are there?

9. A milk dealer buys pure milk at $11\frac{1}{2}$d per gallon. How much water must he add to sell the mixture at 5d. per quart and obtain a profit of 100 per cent. on the selling price?

10. What amount of $2\frac{3}{4}$ per cent. Consols will give an annual income of £152. 17s. 1d.?

74. 1. Simplify $\dfrac{2\frac{1}{4}-1\frac{1}{8}}{\frac{3\frac{1}{2}}{2}\times\frac{4\frac{1}{4}}{11\frac{1}{3}}} \div 2\frac{19}{17}\times\frac{1}{8}$.

2. Add together ·43625 of £2. 10s. and £1·46875; and express the result as the decimal of 12 guineas.

3. What sum of money will, when invested at $4\frac{3}{8}$ per cent. per annum simple interest, give a total income of £1540 in $5\frac{1}{2}$ years?

4. The distance between two places is twice as great by sea as by railway. If the cost per mile by sea is one-third of that by railway, and the railway fare is 8s. 3d., what is the fare by sea?

5. The area of a map is 0·2 of a square metre, and the scale on which it is drawn is 5 centimetres to 10 kilometres. How many hectares does the map represent? (A hectare = 10000 square metres.)

6. In a 200 yards race between A and B, A wins by 10 yards; and in a 200 yards race between B and C, B wins by 10 yards. By how many yards would A win in a 400 yards race between A and C?

7. Divide £106. 4s. 3d. between A, B and C, so that A shall get £5 for every £2 B gets, and for every £3 that B has C shall get £4.

8. A rectangular field containing 12 acres 4087 square yards 1 square foot is 62 yards 1 foot wide. What will be the cost of putting a fence round its four sides at $4\frac{1}{2}$d. per yard?

9. A shopkeeper marks his goods at a price from which he can allow 5 per cent. for cash and still make a profit of 15 per cent. on what the goods cost him. Find the cost price of goods marked at £23.

10. A person possessing £10000 3 per cent. English Corporation stock sells out at $93\frac{5}{8}$, and invests the proceeds in Colonial Corporation 4 per cent. stock at $101\frac{7}{8}$. Find the change in his income, allowing $\frac{1}{8}$ per cent. brokerage on each transaction.

5. 1. Reduce to its simplest form—

$$\frac{5\frac{1}{8}}{4\frac{6}{7}+1\frac{1}{4}} \div \frac{6\frac{3}{4}-1\frac{5}{14}}{2\frac{1}{8}+1\frac{4}{7}} - \frac{2}{5}\frac{3}{3}$$

2. Take $1\frac{1}{7}$ of 2·235135 from $1\frac{1}{1\frac{1}{2}}$ of 2·5824.

3. At what rate per cent. simple interest will £4615. 16s. 8d. amount to £5290. 17s. $11\frac{3}{4}$d. in $4\frac{1}{2}$ years?

4. If 35 men can do a piece of work in 12 days of 9 hours each, how many hours a day would 54 men have to work to do the same piece of work in 7 days?

5. A piece of paper a square decimetre in area weighs 2·125 grams. What is the length in metres of a strip of the same paper 135 millimetres wide which weighs 0·459 kilograms?

6. Two taps can fill a cistern in 4 and 5 hours respectively, and a third can empty it in $1\frac{1}{2}$ hours. The cistern being empty to start with, if the taps are opened respectively at 1, 2, and 3 o'clock, and left running, when will the cistern be empty again?

7. The net income from a property, after deducting 10d. in the £ for local rates and 4 per cent. on the remainder for incidental expenses, is £437. What is the gross income?

8. Find, in square feet, the total area of the six sides of a rectangular slab $6\frac{1}{2}$ feet long, 4 feet wide and 9 inches thick.

9. A hawker bought apples at the rate of 2 for $1\frac{1}{4}$d., and sold them so as to gain $1\frac{1}{2}$d. per dozen. How much did he gain per cent., and how much did he charge for each?

10. A person buys £7200 stock, and after paying income-tax at 1s. 2d. in the £ had an income of £169. 10s. What rate per cent. was the stock paying?

76. 1. Simplify $\frac{2\frac{11}{12}}{4\frac{1}{12}} + \frac{19}{3\frac{1}{8}}$ of $2\frac{1}{8} - \frac{27}{38}$.

2. Find the value of ·375 of a guinea + ·5̇4 of 8s. 3d. + ·02̇7 of £2. 15s.

3. What is the amount required on May 21st to repay, with interest at $4\frac{1}{4}$ per cent. per annum, a loan of £608. 6s. 8d. which was made on the preceding March 2nd?

4. A salver weighs 5 lb. 10 oz. 10 dwt., and the metal of which it is made is 1s. 6d. per oz. If the workmanship, etc. adds to its value to the extent of 4d. for each 3d. in the value of the metal, what is the value of the salver?

5. A rectangular sheet of tin of uniform thickness is 68 centimetres wide and 1·8 metres long, and weighs 268 grams. Find its thickness in centimetres to five places of decimals if a cubic centimetre of tin weighs 7·3 grams.

6. If the front wheel of a carriage is 7 ft. and the hind wheel 10 ft. in circumference, how far will the carriage have travelled when the front wheel has made 1584 revolutions more than the hind wheel?

7. A creditor receives £444. 7s. 6d., being a dividend at the rate of 4s. $11\frac{1}{4}$d. in the £ upon a debt due to him. Find the debt.

8. A rectangular room 50 ft. long and $12\frac{1}{2}$ ft. wide is carpeted with carpet 27 in. wide, costing 3s. $4\frac{1}{2}$d. per yd. Find the total cost.

9. A publican buys spirits, and, after adding $12\frac{1}{2}$ per cent. of water, retails at the rate of 14s. per gallon. If by so doing he makes a profit of 26 per cent. on his outlay, at what price per gallon does he buy?

10. A person sold £19400 3 per cent. stock at $86\frac{1}{8}$, and invested the proceeds in 4 per cent. stock at $96\frac{7}{8}$. Find the change in his income, allowing $\frac{1}{8}$ per cent. brokerage on each transaction.

77. 1. Simplify $\dfrac{2\frac{3}{4}-1\frac{3}{8}}{18\frac{5}{7}-15\frac{9}{56}} \div \dfrac{1+\frac{5}{8\frac{3}{4}}}{15\frac{3}{4}-10\frac{19}{21}}$.

2. Express as vulgar fractions in their simplest terms—(i) ·0375, (ii) $\cdot 3\dot{2}\dot{8}$, (iii) $\cdot 3\dot{2}\dot{8}-\cdot 3\dot{2}\dot{8}$.

3. A man borrows £1, agreeing to pay ½d. per week for the use of the loan. At what rate per cent. per annum is he paying interest?

4. A builder estimates that 18 men can together complete a piece of work in 27 days, but after 6 days 4 men are withdrawn. In how many more days will the whole work be completed?

5. How many pounds of candy at 5 francs per kilogram can an American buy in Paris for 4 dollars 37 cents? (£1 = 4 dollars 83 cents; 1 franc = 9½d.; 1 kilogram = 2·205 lb.)

6. A, B and C, working together, can do a piece of work in $5\frac{5}{17}$ days. A could do it unaided in 12 days and B in 18 days; find how many days C would require for the same work.

7. The gross rental of an estate was £1699. 1s. 3d., but the owner returned 24 per cent. of it to the tenants, then spent £66. 14s. 1d. on repairs, and the agent received 7 per cent. of the remainder; how much was left for the owner?

8. A rectangular tank has a square base, of which the side is 3·75 feet, and is filled with water to the height of 3·2 feet. How many cubic feet of water does it contain, and how many gallons? (6·25 gallons = 1 cubic foot.)

9. In what proportion must a grocer mix two qualities of tea, which cost him 2s. 3d. and 3s. 3d. per lb. respectively, in order to gain 10 per cent. by selling the mixture in 6-lb. parcels at 17s. 5d. per parcel?

10. A capitalist bought £7200 of 3½ per cent. stock for £7038. What is the price of the stock, and what income will be thence derived?

78. 1. Simplify $\dfrac{13}{3+\dfrac{1}{5+\dfrac{6}{1+\frac{1}{8}}}}$.

2. Multiply $32{\cdot}\dot{7}0\dot{2}$ by $11{\cdot}5\dot{4}$; also divide $5{\cdot}5\dot{4}$ by $3{\cdot}3\dot{8}$. Give each answer in decimal form.

3. According to one statement the profits of a certain company are 17 per cent. less than usual, and according to another £867 less than usual. Taking these figures to be correct, find the usual profits of the company.

4. What is the value of a beam of timber whose length is 24 ft. 8 in., breadth 3 ft. 9 in., and thickness 2 ft., at 3s. $8\frac{3}{4}$d. per cubic foot?

5. Two reams of paper, containing the same number of sheets, together weigh 22 kilograms. If every sheet in one ream weighs 20 grams, and every sheet in the other 24 grams, how many sheets are there in each ream?

6. A cistern can be filled by two taps, A and B, in 4 and 6 minutes respectively; both taps are turned full on for 3 minutes, while the waste pipe is also left open. If at the end of the time the cistern is just full, and the two taps are then turned off, how long will it be before the cistern is again empty?

7. If £247. 1s 8d. placed at interest amounts to £252. 0s. 6d. in 4 months, at what rate per cent. per annum is interest allowed?

8. A room is 22 ft. 6 in. long, 13 ft. 5 in. wide, and 9 ft. high. Find the cost of painting the walls at 4s. per square yard, deducting 10 square yards for windows.

9. A wine merchant buys 76 gallons of wine at 5s. $7\frac{1}{2}$d. per gallon. He sells 13 gallons at a loss of 20 per cent., whilst 2 gallons are lost through leakage; at what price per gallon must he sell the remainder in order that he may gain 10 per cent. on the whole transaction?

10. A person holding $3\frac{1}{2}$ per cent. stock sells out when the stock is at 90, and invests the proceeds in 4 per cent. stock at 85. If his annual income is thereby increased by £25, how much of the first stock did he hold, no account being taken of brokerage?

9. 1. Simplify $\frac{\frac{5}{16}-(\frac{7}{8} \text{ of } \frac{17}{21}-\frac{3}{4})}{3\frac{1}{2}-2\frac{7}{11}+1\frac{1}{3}}$.

2. A man buys a field containing 55 ac. 15 per. for £5000, and sells a part measuring 29 ac. 3 ro. 3 per. at £105 an acre. At what price must he sell the remainder so as to gain £261. 9s. $2\frac{1}{2}$d. on the transaction?

3. Without reducing the circulating decimals to vulgar fractions, find (i) the sum of $\cdot 78\dot{9}$, $\cdot 800\dot{2}\dot{6}$, $85\cdot 1\dot{2}$ and $7\cdot 500\dot{1}$; (ii) the difference between $\cdot 1\dot{2}\dot{3}$ and $\cdot 1\dot{2}$.

4. A person's receipts for January are £31. 17s. 6d., and every following month he receives £1. 5s. less than the previous month. Find what his receipts will be for December, and by how much per cent. they fall short of his average monthly receipts for the year.

5. A gives B a number of sovereigns in exchange for French money at the rate of 24 francs for every sovereign, and in this way B makes a profit equivalent to as many shillings as the number of sovereigns he receives. Find to the nearest centime the equivalent of a sovereign in French money. (1 franc = 100 centimes.)

6. If 20 pounds troy of standard gold are coined into 934 sovereigns and 1 half-sovereign, find the value of an ounce of standard gold.

7. Find the true discount of £407. 6s. 8d. due 8 months hence, simple interest being reckoned at $2\frac{3}{4}$ per cent. per annum.

8. A boy having a certain sum to spend, after spending 0·0625 of the amount on a watch and 0·475 on a bicycle, finds that what he has left is five shillings less than the cost of the bicycle. How much did the watch and bicycle cost?

9. By selling a horse for £75 a man lost three times as much per cent. as he would have done by selling him for £85. At what loss per cent. did he sell him?

10. What sum of money must be invested in a $4\frac{1}{2}$ per cent. stock selling at 145 to produce a net income of £150 a year, after paying an income-tax of 8d. in the £?

80. 1. Simplify $2\frac{15}{49}$ of $\dfrac{7}{10+\dfrac{2\frac{1}{2}}{7}} \div \dfrac{1}{8+\dfrac{7}{11-\frac{2}{3}\text{ of }16}}$.

2. Find the least common multiple of 217, 286, 308, 341 and 616.

3. In 1891 the coloured population of a country was 55 per cent. of the whole. In 1901 the coloured population had increased 8 per cent. and the white had decreased 12 per cent.; find what percentage of the whole the white population was in 1901.

4. If with a pace of 2 ft. 9 in. a man walks a mile in 20 minutes, how long will it take him to walk the same distance if he quickens his steps in the proportion of 5 to 4, but decreases the length of his pace to 2 ft. 8 in.?

5. The internal measurements of a box are, length half-a-metre, width 30 centimetres, depth 25 centimetres. Express its capacity as the decimal of a cubic metre.

6. A bell weighing 1 ton 10 cwt. 2 qrs. 4 lb. was composed of copper, tin, and zinc in the proportion of 3, ·6 and ·2. How much of each metal was used?

7. Find to the nearest penny the compound interest on £3182 in 3 years at 2 per cent. per annum.

8. A has 9 sheep for every 5 that B has. A's sheep are worth £1. 5s. each, and B's £1. 12s. 6d. each. If A's flock is worth £53. 2s. 6d. more than B's, how many sheep does each possess?

9. If 7 per cent. of the sale price of an article is equal to 8 per cent. of its cost price, and 9 per cent. of the sale price exceeds 10 per cent. of the cost price by half-a-crown, at what prices is the article bought and sold?

10. A person invests £323. 5s. in $3\frac{1}{2}$ per cent. stock at 90; find the income he obtains from the investment. If in addition he invests £215. 10s. in preference stock at 120, and then obtains 4 per cent. from the two investments together, what is the rate of interest on the preference stock?

31. 1. Simplify $2+\cfrac{1}{4+\cfrac{1}{4+\cfrac{1}{4+\frac{1}{4}}}}$.

2. Find the value of $\frac{2}{7}$ of £12. 4s. $6\frac{3}{4}$d. + $\frac{6}{11}$ of £1. 6s. $1\frac{1}{2}$d. − ·83625 of £5.

3. Find the square root of 139876 and $516\frac{3}{36}\frac{1}{81}\frac{3}{1}$.

4. If the population of a town increases by 5 per cent., the proportion of ratepayers remaining unaltered, by how much per cent. must the contribution of each ratepayer per annum be reduced in order that the amount derived from the rates may be the same as before?

5. Express 10000 metres in miles, yards, and feet, taking a metre as being equal to 39·3708 inches; and express 4 miles in metres, taking 1 yard as being equal to ·9144 metres.

6. Rain fell to the depth of 0·8 inch on a field containing 4·48 acres. If the weight of a cubic foot of water is $62\frac{1}{2}$ lb., find how many tons of rain have fallen on the field.

7. Find the exact difference between the simple and compound interest on £6072 for 3 years at $3\frac{1}{2}$ per cent. per annum.

8. A man drives from A to B at the rate of $12\frac{1}{2}$ miles an hour, and returns walking at the rate of $3\frac{3}{4}$ miles an hour. If the whole journey occupies $6\frac{1}{2}$ hours, what is the distance from A to B?

9. A merchant buys brandy at 16s. 8d. per gallon, and after diluting it with water sells the mixture at 3s. 4d. per pint, thereby making 100 per cent. profit. How much water per gallon does he add?

10. An investor who has £7800 railway stock, paying 5 per cent., sells out at 125 and reinvests the money in 4 per cent. brewery debentures at $97\frac{3}{8}$. Find the increase in his income, brokerage at $\frac{1}{8}$ per cent. being charged on each transaction.

82. 1. Express as a decimal—

$$\frac{(\frac{3}{4}+\frac{6}{7})\times(\frac{2}{3}-\frac{1}{6})}{1\frac{27}{350}\div\frac{231}{1681}} - \frac{1\cdot25\times(3\cdot5-0\cdot0056)}{36\cdot4\div4\cdot9}.$$

2. How many times is £·02665625 contained in £2638. 19s. 4½d.?

3. The interest on a certain sum of money for 3 years at 4 per cent. simple interest is 15 guineas. What is the interest on one-third of the sum for 4 years at 5 per cent.?

4. Divide £876. 1s. 6¼d. between A, B, C and 225 other persons, so that A may have twice as much as B, B twice as much as C, and C eight times as much as one of the equal shares of the 225 other persons.

5. Find, to the nearest litre, the capacity of a cistern 2·35 metres long, 1·87 metres wide, and 1·57 metres deep. (A litre is a cubic decimetre.)

6. A farmer bought a horse and gave a bill of exchange for £156, due eight months hence, at 4½ per cent. per annum. He sold the horse at once for £180; find his gain per cent.

7. A debtor owed £5146, and had sufficient assets to pay 9s. 4½d. in the £ if the cost of liquidation were not deducted, but after the process of liquidation a creditor, to whom £800 was owed, received £338. 6s. 8d. Find the whole cost of liquidation.

8. Standard silver contains 37 parts of pure silver and 3 parts alloy. From 1 lb. troy of standard silver 66 shillings are coined. If pure silver is worth 27½d. per oz., what is the value of the pure silver in a shilling?

9. The population of a town increases by 20 per cent. each year. At the end of how many years will the population be nearest twice its original number?

10. A capitalist lays out £12696 in the purchase of a 3 per cent. stock, and derives therefrom an income of £360. If the expenses of purchase are at the rate of £4 for every £500 stock, what was the price at which he purchased?

3. 1. Simplify $\frac{\frac{3}{4}-\frac{1}{6}+\frac{5}{8}}{\frac{1}{4}+\frac{5}{6}-\frac{3}{8}}$ of $5\frac{2}{3}-4\frac{1}{12}$ of $\frac{7\frac{3}{7}-1\frac{2}{3} \text{ of } 2\frac{1}{7}}{5\frac{1}{3} \text{ of } 1\frac{2}{3}-1\frac{1}{6}}$.

2. Find the G.C.M. of 304451 and 693997; also the L.C.M. of 46332 and 51975.

3. Add together $\cdot 0\dot{0}0\dot{9}\dot{9}$, $\cdot 1\dot{0}00\dot{2}$, and $\cdot\dot{0}\dot{1}$; and reduce $\cdot 54\dot{9}5\dot{0}$ to a vulgar fraction in its lowest terms.

4. Find, to three decimal places, the square root of 2, $\cdot 162$ and $\cdot 2\dot{8}\dot{7}$.

5. A skating rink 20 metres long and 15 metres wide is covered with water to the depth of a decimetre. Find the weight of the water in kilograms? (A cubic centimetre of water weighs 1 gram.)

6. Find the amount of £6250 placed at compound interest for 2 years at 10 per cent.

At what rate per cent. simple interest would it have to be invested that it might amount to the same sum in 3 years?

7. Find the difference between banker's discount and true discount on a bill for £515 due 8 months hence at $4\frac{1}{2}$ per cent. per annum.

8. The road from M to N is one-half uphill and one-fourth downhill. A and B, who start at the same time from M, travel equally on the level, but uphill A gains 2 min. 40 sec. in each mile, whilst downhill B gains 50 sec. in each mile. If A arrives at N 15 min. 45 sec. before B, what is the distance between M and N?

9. Two articles cost £32. 5s. and were sold for £32. 19s. 9d., one at a profit the cheaper at a loss, the rate per cent. being 5 in each case. What was the selling price of the more valuable article?

10. A capitalist lays out £12000 in three investments, namely, $\frac{4}{15}$ of it in a business which pays $7\frac{1}{2}$ per cent. per annum, $\frac{5}{8}$ in a speculation by which he gets only $1\frac{1}{2}$ per cent., and the remainder at such a rate that his whole interest on the three investments jointly amounts to 3 per cent. of the sum laid out. What is that rate?

84. 1. Simplify $\frac{3}{5}\left\{\begin{matrix}1\frac{1}{4}\\1\frac{1}{12}\end{matrix}\right\}$ of $\frac{2}{3}+\frac{3\frac{1}{2}-2\frac{5}{8}}{1\frac{1}{4}+\frac{5}{6}}-\frac{8\frac{1}{5}}{7\frac{4}{5}}\Big\}$.

2. Express $(\cdot645+\cdot312\dot{8}\dot{7})\div1\cdot2\dot{7}$ in its simplest form.

3. Find the square root of 41·0881 and 823737·76.

4. Goods are manufactured at a cost of £2. 14s. 6½d. per ton. 360 tons are exported at a cost of £5. 10s., and are sold, after paying duty at the rate of 3s. 5½d. per ton, at £3. 7s. 11d. per ton; how much did the manufacturer gain?

5. Taking a metre as 39·37 inches, find correct to three significant figures by what decimal fraction of itself a distance of 8 kilometres differs from 5 miles.

6. Find the present value of £838, due 19 months hence, at 3 per cent. per annum simple interest.

7. Three partners own a business, their capitals being severally in the proportion of 1, 2, 4. Their profits, which are 15 per cent. of their capital, amount to £3591; what capital has each in the business?

8. A drawer contains 150 coins consisting of half-sovereigns, florins, and shillings. The value of the half-sovereigns is equal to that of the florins and shillings together, and the number of half-sovereigns is the same as that of the florins; how many coins are there of each kind?

9. A merchant buys two kinds of sherry, which could be sold without profit at the rate of 40s. per dozen and 36s. per dozen respectively. In what proportion must the two wines be mixed so that he can sell the mixture at 42s. per dozen and thus make 12 per cent. profit on his original outlay?

10. The difference between the incomes derived from investing a certain sum in 6 per cent. stock at 126 and a similar sum in 4½ per cent. stock at 105 is £22. 10s. What is the amount invested in each kind of stock?

5. **1.** Simplify $\frac{2\frac{3}{4}}{1\frac{1}{4}}+\frac{27}{40}\div\frac{(3\frac{1}{3}-2\frac{1}{6})\text{ of }3\frac{1}{4}-1\frac{7}{12}}{2\frac{1}{13}+\frac{3}{7}\text{ of }(16-3\frac{5}{9})}$.

2. A boy found correctly $\cdot 24\dot{7}$ of a certain length instead of $\cdot\dot{2}4\dot{7}$ of that length, and the difference between his result and the correct result was 1 yard 1 foot 5 inches. What was the correct result?

3. Find the exact square root of $5\frac{20}{121}$, and the square root of $\frac{2}{11}$ to four decimal places.

4. The paint required for giving one coat to one side only of a wooden fence 182 yards long cost 12s. 10d. If 1 lb. of paint covers a surface of 26 square yards and costs 11d., find the height of the fence.

5. A rectangular column of iron is 10 metres long, and the cross section is a square whose side is 125 millimetres. The column weighs $1218\frac{3}{4}$ kilograms; find the weight, in grams, of a cubic centimetre of iron.

6. If the circumferences of the two wheels of a bicycle are 48 and 196 inches, after how many turns of each will two points in the circumferences come back into the same relative position?

7. What is meant by discounting a bill? Which party is benefited by reckoning interest as discount?

Show the amount of error in discounting a bill for £150 due 4 months hence at 5 per cent. per annum, if interest is reckoned as discount.

8. A and B start from M at 9 a.m. and 9·20 a.m. respectively to cycle at N, which is $87\frac{1}{2}$ miles distant. B passes A 35 miles from M, and arrives at N 4·50 p.m.; at what time does A arrive?

9. One alloy of metals contains 90 per cent. of copper and 10 per cent. of tin; another alloy contains 93 per cent. of copper and 4 per cent. of tin. Find in what proportions they must be mixed that the mixture may contain 9 per cent. of tin, and what percentage of copper it will contain.

10. A person who had 150 £10 shares in a company which was paying 3 per cent. per annum, sold them when they were quoted at £$1\frac{1}{3}$ premium and invested the money in 5 per cent. debenture stock at par. How was his income affected by the transfer? (Neglect brokerage.

86. 1. Simplify $\dfrac{\cdot 12 \times (\cdot 0104 - \cdot 002) + \cdot 36 \times \cdot 002}{\cdot 12 \times \cdot 12}$.

2. Add $\cdot 4097\dot{2}$ of 3s. to $\cdot 2\dot{7}$ of 8s.; and express the result as the decimal of £1.

3. A bankrupt's assets amounted to £22314. 10s. 7½d., and this enabled him to pay 13s. 9d. in the £. What were his total liabilities?

4. A man buys a farm of 120 acres for £3225. He repairs the buildings and lets the farm at 28s. per acre, thereby getting a return of $3\frac{1}{2}$ per cent. on his total outlay; how much did he spend on repairs?

5. Assuming that a metre is 39·37079 inches, express a square metre in square feet and the decimal of a square foot correct to 3 significant figures.

6. Find the difference between the simple and compound interest on £1000 for 3 years at 5 per cent. per annum.

7. A man has £50 for a journey to Paris and back. In Paris £1 is worth 25 francs 20 centimes. He changes all his money, and has 201 francs 60 centimes left. In London 1 franc is worth 9½d.; find what he lost by changing more than he needed for the journey?

8. An alloy contains tin and copper in the proportion of 2·1 to 37·9. Find to the nearest penny the value of 3 cwt. 64 lb. of the alloy when tin and copper are respectively worth £132. 10s. and £78. 15s. per ton.

9. A dealer sells bicycles of two kinds, one costing him £2 each more than the other. He could sell the dearer ones at £18 each and make a profit of 44 per cent. on what they cost him; how much per cent. would he gain by selling 5 of these and 7 of the cheaper ones for £170?

10. An investor holding £10000 British Corporation 3 per cent. stock sells out at $92\frac{1}{4}$, and invests the proceeds in railway 6 per cent. £20 shares when they are at £5 premium. Find the alteration in his income. (Brokerage and other charges to be neglected.)

87. 1. Simplify $\dfrac{0{\cdot}2 \times \frac{3}{5} \div (\frac{8}{9}\frac{5}{9} - 0{\cdot}35)}{1 + \dfrac{3\frac{1}{2}}{0{\cdot}4 - \frac{1}{20}}}$.

2. Express $\cdot 32145$ and $\cdot 01325$ as vulgar fractions in their lowest terms.

3. What sum of money lent at 5 per cent. per annum, compound interest, will amount in $2\frac{1}{2}$ years to £904. 1s?

4. A carpet 19 ft. 6 in. by 15 ft. 9 in., costing 16s. per square yard, is laid down in a room measuring 23 ft. by 17 ft., and the rest of the floor is covered with linoleum at 7d. per square foot. Find the total cost to the nearest penny.

5. A journey of 725 kilometres can be performed by railway in 18 hours. Find approximately the average number of miles per hour at which the train travels. (39·37 in.= 1 metre.)

6. The rates of running of A and B are as 14 to 11. If A gave B 36 yards start, how far must the running post be for A to reach it 36 yards ahead of B?

7. A brick wall is to be built 53 ft. 4 in. long, 8 ft. high, and 1 ft. 8 in. thick. If the volume of each brick is 48 cubic in., how many will be required, allowing $3\frac{1}{8}$ per cent. of the whole space occupied by the mortar?

8. Water flows into a rectangular cistern, 13 ft. long by 5 ft. wide and 7 ft. deep, through a pipe 16 sq. in. in area, at the rate of 3 ft. 3 in. per second, and flows out through another 12 sq. in. in area, at the rate of 3 ft. 4 in. per second. If when both pipes are opened the water in the cistern is 1 ft. deep, how soon will it be full?

9. By selling 1728 lb. of a blend consisting of 5 parts coffee to 3 parts chicory for £118. 16s. a dealer makes a profit of 32 per cent. on his outlay. If the coffee cost him 14d. per lb., how much per lb. did the chicory cost him?

10. A man sells out $3\frac{1}{2}$ per cent. stock at $97\frac{5}{8}$, and reinvests the money in $4\frac{3}{4}$ per cent. debentures at $124\frac{7}{8}$, and increases his income by £6. 3s. Find the amount of his $3\frac{1}{2}$ per cent. stock, brokerage $\frac{1}{8}$ per cent. being charged on each transaction.

88. 1. Simplify $\left[0{\cdot}25 \times 0{\cdot}266 \times 116 - \frac{107{\cdot}12}{669{\cdot}5} \cdots 01\right] \times \frac{46\frac{1}{4} + 17\frac{1}{2}}{46\frac{1}{4} - 17\frac{1}{2}}$

2. Find the value of $2{\cdot}15\dot{9}\dot{0}$ of 7 days 5 hrs. 30 mins.

3. Divide 12826 proportionally to the numbers $\cdot 1\dot{6}, \cdot\dot{4}, \cdot 125$

4. If 3 cwt. of hay feeds 14 ponies for $4\frac{1}{2}$ days, how many horses will 9 cwt. feed for 3 days if 2 horses eat as much as 3 ponies?

5. Express in kilograms (to two places of decimals) the weight of 10 gals. of water, having given that a metre = 39·37 in., that a cubic centimetre of water weighs 1 gram, and that a gallon occupies 277·274 cubic inches.

6. What is the true discount on £257. 8s. $8\frac{1}{4}$d. on a bill due 210 days hence at $4\frac{1}{2}$ per cent. per annum?

7. A closed cubical box has an edge 2 ft. 10 in., and the material is 3 inches thick. Find the weight of the box, if 3 cubic feet of the material weigh 100 lb.

8. A boatman, rowing against the stream, passes a log floating down and 12 minutes afterwards is $\frac{3}{4}$ of a mile away from it. If in 40 minutes the boatman rows 2 miles up stream, how long will he take to row $1\frac{1}{2}$ miles down stream?

9. A merchant buys goods to the value of £5760 abroad, but has to pay a percentage for import duty. He refuses an offer which would give him a profit of 2·8 per cent., but eventually is forced to accept an offer of £612 less, which gives him a loss of 5·7 per cent.; find the percentage of import duty.

10. A person who has £32000 Corporation 3 per cent. stock sells out at $97\frac{5}{8}$, and reinvests the proceeds in 5 per cent. Railway debentures at $159\frac{7}{8}$. Find the increase in his income, a brokerage of $\frac{1}{8}$ per cent. being charged on each transaction.

89. 1. Express as a decimal in its simplest form—

$$\frac{1{\cdot}463}{7{\cdot}315} + \frac{\frac{3}{5} \text{ of } 141{\cdot}75 - \frac{4}{5} \text{ of } 38{\cdot}125}{18{\cdot}9 \times 5 + 1{\cdot}22 \times 25}.$$

2. Multiply ·3076 by 1·07$\dot{2}$, and divide the product by ·008, expressing the result in decimal form.

3. Divide 11s. 1¼d. in the ratio of $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$.

4. If it takes 126 yds. of cloth 38⅓ in. wide to make 34 suits of clothes, how many yards of cloth, 34½ in. wide, will it need to make 51 suits of a size requiring one-fifth more material than the first kind?

5. A man starts along a road and walks 5328 metres, then 74 hectometres, then 2 kilometres, then 943 decametres. Find, approximately, how many yards farther he will have to walk to complete 30 kilometres. (1 metre = 39·37 inches.)

6. Three persons, A, B, and C, purchase a ship. A paid for $\frac{2}{3}$, B for $\frac{1}{5}$, and C paid £400; what part of the ship had C, and how much did A and B pay?

7. Explain the difference between *trade* discount and *true* discount. A tradesman pays for goods bought on March 5th by a bill nominally due on July 26th for £257. 10s.; what was the price of the goods, true discount being reckoned at the rate of 7½ per cent. per annum, and days of grace allowed?

8. Four men start together with buckets, holding respectively 1 gal., 2 gals., 3 gals., and 4 gals., to fill a tank from taps which supply water at the rates of ½ gal., 1½ gals., 2 gals., and 2½ gals. a minute respectively. After what interval of time will all four men be again starting together to fill their buckets, assuming that each bucket is emptied instantaneously the moment it is full?

9. A man pays 10 per cent. of his gross income in rates and taxes, 15 per cent. of the remainder in rent, and saves annually 6¾ per cent. of his gross income. If his expenditure, exclusive of rent, rates and taxes, amounts to £418. 10s., what is his gross income?

10. If by delaying an investment in 2½ per cent. stock, while the price fell from 90 to 89⅜, the annual income to be received is increased by £6. 5s., what is the sum invested?

90. 1. Express as a decimal in its simplest form—

$$\frac{\cdot\dot{5}\dot{4}-\cdot\dot{5}\dot{4}}{\cdot\dot{4}\dot{5}+\cdot\dot{4}\dot{5}} \div \left\{ \cdot 0375 \text{ of } \left[4+\frac{1}{49+\frac{1}{1+\frac{1}{3}}} \right] \right\}.$$

2. Divide £89. 12s. 1d. in the ratio of $1\frac{1}{2}$, $2\frac{1}{4}$, $3\frac{1}{3}$.

3. What is the length, in yards, of a side of a square room which is covered by $206\frac{1}{4}$ yds. of carpet 33 in. wide?

4. A corn dealer mixes 5 qrs. 3 bush. 1 pk. of oats at 34s. 8d. per quarter with 3 qrs. 3 pks. of barley at 2s. per peck. What is the cost of 2 qrs. 1 bush. of the mixture?

5. Find the volume in hectolitres and the weight in kilograms of a rainfall of 3 centimetres on an area of 4000 square metres.

6. The captain of a steam yacht wishes to buy coal. He can get it at A, 250 miles distant, for 8s. per ton, or at B for 9s. 3d. per ton. He estimates that the cost of steaming to either port increases the price per ton at the rate of 3s. per 100 miles; if the expense of coaling at A is $3\frac{1}{8}$ per cent. less than that of coaling at B, how far is the yacht from B?

7. A reduction of 10 per cent. in the price of iron would enable a purchaser to obtain 1 cwt. more for a sovereign. What is the present price per ton?

8. The price of silver is 5s. $0\frac{1}{2}$d. per ounce. A mixture of gold and silver weighs 333 ounces, and is worth £869. 13s. $10\frac{1}{2}$d. If the proportions of gold and silver had been interchanged, it would only have been worth £544. 3s. $4\frac{1}{2}$d. Find the price of gold per ounce, and the proportions of gold and silver in the mixture.

9. The directors of a railway company reduced the fare between two stations by sixpence, and in consequence the number of passengers travelling between these two stations increased by 12 per cent. and the total receipts increased by 4 per cent. Find the reduced fare.

10. If a person sells out $2\frac{1}{2}$ per cent. Consols at $93\frac{1}{8}$ and buys 3 per cent. Local Loans stock at $101\frac{1}{8}$, and by this transaction increases his income by £11. 10s. per annum, how much had he in the $2\frac{1}{2}$ per cents. at first? (Allow $\frac{1}{8}$ per cent. brokerage on each transaction.)

91. 1. Find the area of a right-angled triangle when the two sides containing the right angle are (i) 7 cm. and 5 cm.; (ii) 3 ft. 4 in. and 2 ft. 3 in.

2. Find the hypotenuse of a right-angled triangle of which the base and the perpendicular height are respectively 1 ft. 9 in. and 2 ft. 4 in.

3. The area of a triangular piece of wood is 30 sq. ft. 88 sq. in. Find the altitude, if the base measures 9 ft. 4 in.

4. A picture hangs from a nail by a cord passed through two rings in its upper edge 10 inches apart and tied together. What area of wall does the cord surround if the nail be 8 inches from the picture?

5. A ladder, when standing upright against a wall, reaches $12\frac{1}{2}$ feet up the wall. How far must the foot of the ladder be pulled out from the wall to lower the top 6 inches?

6. A footpath goes along two adjacent sides of a rectangular playing-field 196 yards long and 147 yards wide. What distance would be saved if the path were straight across the field from corner to corner?

7. A rectangular garden is 56 yards long, and the distance across the field from corner to corner is 65 yards. How many yards of fencing will be required to enclose it?

8. A ladder 17 feet long has its foot drawn out 5 feet from the bottom of a vertical wall. How far up the wall does the ladder reach? (Give your answer correct to the nearest inch.)

9. Find the difference between the area of a triangle, whose sides are respectively 16, 63, and 65 centimetres, and the area of a square whose perimeter is the same as that of the triangle.

10. Find the cost of painting the gable end of a house at 1s. 6d. per sq. yard. The width of the house is 25 feet, the ridge of the roof rises 10 feet above the eaves, and the eaves are 32 feet from the ground.

92.

Take π to be $\frac{22}{7}$ unless otherwise stated.

1. Find the circumference (i) of a circle whose diameter is $10\frac{1}{2}$ in.; (ii) of a circle whose radius is 1 ft. 9 in.

2. Find the area of a circle (i) whose radius is $10\frac{1}{2}$ inches; (ii) whose circumference is 11 inches. Find, to three significant figures, (iii) the radius of a circle whose area is 100 square centimetres.

3. Find, in square feet and square inches, the area of a circular ring, given that the outer diameter is 2 ft. 4 in. and the inner diameter 1 ft. 2 in.

4. The circumference of a wheel is 5 ft. 6 in. What is the distance of the spoke from the centre to the rim?

5. How many times will the driving-wheel of a locomotive engine, 7 feet in diameter, turn round in a minute, if the engine is running at the rate of 45 miles per hour?

6. A circular flower-bed, 11 ft. 8 in. in diameter, is to be made in the centre of a rectangular grass-plot, 24 ft. 3 in. by 15 ft. 9 in. What will be the area of the remaining portion of the grass-plot?

7. Find the cost, to the nearest shilling, of gilding a circular ceiling 20 feet in diameter, at 1s. $4\frac{1}{2}$d. per sq. foot.

8. Find the cost of putting a curb-stone, $1\frac{1}{2}$ feet wide, round a well 9 feet in diameter, at 2s. 6d. per square foot.

9. If a pressure of 15 lb. on every square inch be applied to a circular plate 24 feet in diameter, what is the total pressure in tons? (Give your answer correct to the nearest integer.)

10. In a right-angled triangle the sides which contain the right angle are 3 cm. and 4 cm. Find the area of the circle described on the hypotenuse as diameter. ($\pi = 3{\cdot}1416$.)

93. *Take π to be $\frac{22}{7}$ unless otherwise stated.*

1. The height of a square prism is $7\frac{1}{2}$ feet; each edge of the base measures 2 ft. 6 in. Find the area of the whole surface.

2. The height of a triangular prism is 5 feet, and the edges of the base measure 6 inches, 8 inches, and 10 inches respectively. Find the area of the whole surface.

3. Find the volume of a prism, whose base is a right-angled triangle, from the following measurements: side, 1 ft. 3 in.; hypotenuse, 2 ft. 1 in.; height, 3 ft.

4. Find the volume of a cylinder (i) the diameter of whose base is 2 ft. 4 in., and whose height is 6 ft. 3 in.; (ii) the circumference of whose base is 3 ft. 8 in., and whose height is 5 ft. 2 in.

5. Find the number of cubic inches of material used in making a hollow cylinder, the external diameter of which is 8 inches, the internal diameter 6 inches, and the height of the cylinder 14 inches.

6. If 114 cu. yds. 2 cu. ft. of earth are dug out to make a well 14 feet in diameter, what is the depth of the well?

7. The diameter of the base of a right cylinder is 14 inches, and the height is 10 inches. Find the area (i) of the curved surface, (ii) of the whole surface.

8. Find the volume of a hollow cylinder (open at both ends) whose external diameter is 44 cm., thickness 2 cm., and height 25 cm.

9. Find the number of cubic centimetres in a cylinder of radius 9 millimetres and height 15 centimetres. ($\pi = 3{\cdot}1416$.)

10. A rectangular metal plate, 2 cm. thick, measures 25·4 cm. by 13·8 cm. Find (i) its volume. ($\pi = 3{\cdot}14$.) Twenty holes are bored in it, each 2 cm. in diameter. Find (ii) the volume of each hole. Assuming that 1 c.c. of the metal weighs 11·4 grams, find (iii) the weight of the plate after the holes have been bored in it. (Give result (iii) correct to three significant figures.)

94.

Take π to be $\frac{22}{7}$ unless otherwise stated.

1. A right pyramid, 3 metres high, stands on a square base whose side is 8 metres. Find the area of one of the triangular faces.

2. Find the slant surface of a right pyramid 1 foot high, standing on a rectangular base whose length and breadth are respectively 5 ft. 10 in. and 10 inches.

3. Find the volume of a pyramid whose base is a square, each side of which is 5 ft. 8 in., and whose perpendicular height is 27 ft.

4. Find in cubic feet and cubic inches the volume (i) of a cone the diameter of whose base is 7 feet and whose perpendicular height is 10 feet; (ii) of a cone the circumference of whose base is 22 feet and whose height is 7 ft. 3 in.

5. Find the curved surfaces of the cones of which (i) the slant height is 4 ft. 5 in. and the radius of the base 2 ft. 4 in.; (ii) the vertical height is 4 ft. and the radius of the base 1 ft. 2 in.

6. Find the weight of a stone pyramid 50 feet high standing on a square base whose side is 3 ft. 6 in., assuming 1 cubic foot of stone weighs 240 lb.

7. How many cubic feet of air are there in a conical-shaped tent 8 feet high and 10 feet in diameter?

8. A conical mound of earth is 264 yards in circumference, and the length of its shape, from the foot to the summit, is 70 yards. How many cubic yards of earth are there in the mound?

9. Find the cost of painting a conical spire whose slant height is 120 feet, and the circumference of whose base is 72 feet, at 2s. 10d. per square yard.

10. Find (in tons, cwt., etc., to the nearest ounce) the weight of the water contained in a conical vessel having a diameter of 4 ft. 8 in. at the surface and a depth of 9 ft. (Assume 1 cubic foot of water weighs 1000 ounces.)

95.

Take π to be $\frac{22}{7}$ unless otherwise stated.

1. Find the surface of a sphere (i) whose diameter is 1 ft. 2 in.; (ii) whose radius is 1 ft. 2 in.

2. Find the volume of a sphere (i) whose diameter is 6·3 centimetres; (ii) whose radius is 2·1 centimetres.

3. The outer diameter of a spherical shell is 10 inches, and the thickness of the shell 1 inch. Find its volume.

4. The exterior diameter of a hollow sphere is 22 inches, and the thickness of the shell 3 inches. Find its volume. Give the result in cubic inches.

5. A ball of iron, 4 inches in diameter, weighs 2 lb. What is the weight of a ball whose diameter is 12 inches?

6. How many spherical bullets, each $\frac{1}{2}$-inch in diameter, could be moulded from a rectangular block of lead 1 ft. 10 in. long, 1 ft. 2 in. wide, and 5 in. thick?

7. Find the volume of a sphere 6 inches in diameter. And find, to the nearest penny, the cost of painting the outside of such a sphere at the rate of 4d. for every 25 inches. ($\pi = 3{\cdot}1416$.)

8. Find the weight of 42 cast-iron cannon balls, each 4 inches in diameter, assuming that 1 cubic inch of iron weighs $4\frac{1}{2}$ ounces.

9. Find the weight of a spherical shell 11 inches in diameter and 3 inches thick, assuming 1 cubic foot of iron weighs 4 cwt.

10. Supposing the ball on the top of St. Paul's Cathedral to be a perfect sphere, 6 feet in diameter, what would be the cost of gilding it at 7d. per square inch?

96.

Take π to be $\frac{22}{7}$ unless otherwise stated.

1. The area of a right-angled triangle is 30 sq. feet, and the length of one of the sides containing the right angle is 12 feet. Find the length of the hypotenuse.

2. A bicycle wheel is $3\frac{1}{2}$ feet in diameter and turns exactly 168 times in going round a circular track. How many square yards are there in the plot enclosed by the track?

3. The outside measurements of a box with a lid are 12 in. by 10 in. by 8 in., the wood of which it is made being $\frac{1}{2}$ in. thick. How many cubic inches of wood were used in making it?

4. What is the circumference of an 11-inch (diameter) howitzer shell? ($\pi = 3{\cdot}1416$.)

5. Two straight roads cross at right angles. A and B start walking at the same time from the point where the roads meet, A going along one road at the rate of 4 miles an hour, and B along the other road at the rate of 3 miles an hour. How far apart will they be in 10 minutes after starting?

6. A length of cord 0·2 cm. in diameter is made into a solid spherical ball of radius 5 cm. Find, in metres, the length of the cord. ($\pi = 3{\cdot}1416$.)

7. A cone of silver whose base is 18 inches in diameter and whose height is $4\frac{1}{2}$ inches is melted and made into a spherical ball. Find the diameter of the ball.

8. A cylindrical cask, closed at both ends, is 3 feet high and 3 feet in diameter. Find its cost, to the nearest penny, if the price of the wood is 6d. per square foot.

9. The top of a circular stool is cut from a piece of wood 18 inches square and $\frac{1}{2}$ inch thick, so as to be as large as possible. What volume of the wood is wasted in the process?

10. The inner diameter of a cylindrical iron pipe is 10 inches, and the thickness of the metal is 1 inch. Find the weight of a 12-inch length of the pipe, assuming that 1 cubic foot of iron weighs 480 lb.

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Exercise 195

Find the L.C.M. of the following numbers:—

1. 2, 3, 6 and 8	7. 8, 12, 20 and 100	13. 8, 10, 15 and 18
2. 3, 7, 12 and 14	8. 5, 15, 18 and 20	14. 12, 28, 35 and 40
3. 5, 8, 15 and 24	9. 8, 12, 15 and 20	15. 10, 15, 24 and 32
4. 9, 11, 18 and 22	10. 16, 21, 28 and 24	16. 9, 16, 18 and 24
5. 7, 9, 14 and 21	11. 9, 10, 15 and 20	17. 12, 20, 36 and 54
6. 12, 15, 18 and 27	12. 12, 18, 24 and 27	18. 15, 33, 40 and 55

Introductory to Vulgar Fractions the pupils should re-work Exs. 121 *and* 133 *orally. The answers to the questions in Ex.* 196 *are to be stated in figures as well as orally. Teachers are also recommended to illustrate the meaning of fractions from an ordinary foot-rule and construct questions on the scale.*

XXI. VULGAR FRACTIONS: FIRST PRINCIPLES

Exercise 196

1. If an apple be cut into 4 equal pieces, what part of the apple will (*a*) 1, and (*b*) 3 of the pieces be?

2. If you cut an apple into 8 equal pieces and gave 3 of the pieces to one boy and 5 of the pieces to another boy, what part of the whole apple would each have?

3. How many sixths would make up a whole apple?

4. What parts of a shilling are (*a*) 1 penny, (*b*) 5 pennies, and (*c*) 7 pennies?

5. What parts of a yard are (*a*) 1 foot, (*b*) 2 feet, and (*c*) 3 feet?

6. What parts of a shilling—using the simplest form—are (*a*) $\frac{3}{12}$, (*b*) $\frac{6}{12}$, and (*c*) $\frac{9}{12}$?

7. How many quarters are there in (*a*) $\frac{2}{4}$, and (*b*) $\frac{8}{12}$ of an orange?

8. From $\frac{1}{2}$ of an orange how many (*a*) fourths, (*b*) eighths, and (*c*) tenths of the whole orange could be cut?

9. From $\frac{3}{4}$ of a loaf how many (*a*) eighths, and (*b*) twelfths, and (*c*) sixteenths of the whole loaf could be cut?

10. Which is the greatest and which is the smallest part: $\frac{2}{3}$, $\frac{3}{4}$, or $\frac{5}{6}$ of a loaf?

11. If I cut a lot of apples each into 5 equal pieces, what fraction of an apple will each piece be called?

12. If 7 of these pieces ($\frac{7}{5}$) be given to a boy, how many apples will he have?

13. If 14 of these pieces ($\frac{14}{5}$) be given to him, how many apples will he have?

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Third Stage : Longer examples on the portions of the subject taken in the *First Stage* are dealt with.

Fourth Stage : Compound expressions and their resolution into factors, and the various types of fractions are considered.

(ii) The examples are very numerous, well graduated, and include, in every section, a large number adapted for oral as well as for written work. There are 3750 examples altogether ; tedious questions have been carefully avoided.

(iii) It is very desirable that the interest and intelligence of young pupils should be directed to the practical side of the subject as soon as possible ; hence questions requiring the use of symbols to denote numbers, simple equations, and problems are introduced early in the *First Stage* immediately after addition.

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2. A man walks 168 miles in 4 days. He walks 3 miles each day (after the first) more than on the preceding day. How many miles did he walk the first day?

3. *A* and *B* starting at the same time from two towns, and walking uniformly, meet in 5 hours. Had each walked a mile an hour faster, they would have met in 4 hours. It being known that *A* walks at the rate of five miles an hour, what is *B*'s rate of walking? And what is the distance between the towns?

4. The difference between the numerator and the denominator of a fraction is 8; and if each be increased by 17, the fraction becomes equal to $\frac{3}{4}$. What is the fraction?

5. A man buys oranges at 6d. per dozen, and an equal number at 9d. per score. He sells them at 9d. per dozen, and makes a profit of 5s. 6d. How many oranges did he buy?

6. A draper bought 80 yards of silk, some of it at 2s. per yard and the rest at 3s. per yard. He finds that by selling the lot at 3s. per yard he would gain 10s. more than by adding 6d. per yard to the price of each. How many yards of each quality did he buy?

7. An excursion train carries first, second, and third-class passengers—760 in all. There are twice as many first as second-class passengers. The first-class fare is 7s. 6d., second 5s. 6d., third 4s., and the total fares amount to £186. How many first, second, and third-class passengers are there in the train?

8. A passenger finds that his train actually arrives at 4 P.M. If he had travelled at 60 miles an hour, he would have arrived at 3.30 P.M.; while if at 40 miles an hour, he would have arrived at 4.15 P.M. At what time did he start?

9. A person has a certain sum of money owing to him. When he has received a half, a third, and a twelfth of it he will still have 5 guineas to receive. What is the total amount due to him?

10. *A* had twice as much money in his purse as *B*; but when *A* had paid £10 to *B* one-third of his money was equal to one-quarter of *B*'s money then. How much money had each in his purse at first?

11. When *A* and *B* start playing marbles together, *A* has half as many again as *B*. *A* loses 37 and then *B* has half as many again as *A*. With what number of marbles did each begin playing?

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